316(b) Stated Preference Survey Peer Review Document

Table of Contents

Acronyms **5**
1 Introduction **6**
1.1 Purpose of the Section 316(b) Regulations 6
1.2 Legal History of the Section 316(b) Regulations 6
1.3 Analysis for the Proposed 316(b) Existing Facilities Rule 7
2 Choice Experiment Framework **8**
3 Experimental Design **13**
4 Pre-Tests and Pilot Tests **15**
5 Sampling Design and Sample Frame **17**
6 Mail Survey Responses **21**
7 Non-Response Study **24**
7.1 Non-Response Study Responses 24
7.2 Statistical Testing of Mail Survey and Non-Response Data 26
8 The Random Utility Model **42**
8.1 Model Specification 42
8.2 Model Estimation 44
8.3 Approach for Estimating Model Weights 45
8.4 Model Results 48
8.5 Validity Tests 55
9 Estimation of Implicit Prices and WTP **64**
9.1 Estimation of Implicit Prices 64
9.2 [redacted] 67
10 Results for Regulatory Options **69**
11 References **75**
Appendix A: Survey Example **80**
Appendix B: Experimental Design for the Regional and National Surveys **101**
Appendix C: Preview and Reminder Letters for the Northeast Mail Survey **111**
C.1 Preview Letter for the Northeast Mail Survey 112
C.2 Cover Letter for the First Mailing of the Northeast SP Survey 113
C.3 Post Card Reminder for the Northeast SP Survey 114
C.4 Cover Letter for the Second Mailing of the Northeast SP Survey 115
C.5 Final Reminder Letter for the Northeast SP Survey 116
Appendix D: Priority Mail Non-Response Questionnaire for the Northeast Region **117**
Appendix E: Telephone Non-Response Screener Script **121**
Appendix F: Preview and Cover Letters for the Non-Response Study **128**
F.1 Cover Letter for the Priority Mail Non-Response Study 129
F.2 Preview Letter for the Telephone Non-Response Study 130
Appendix G: Preliminary Northeast Models **131**
G.1 Northeast Linear Model with Interactions for Gender and Education 131
G.2 [redacted] 133
G.3 [redacted] 134
Appendix H: [redacted] **136**

Figures

Figure 2-1 – Example Choice Experiment Question from the Northeast Survey 11
Figure 6-1 – Summary of Responses to Questions Regarding Respondent Confidence across All Survey Regions 24
Figure 7-1 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Northeast Region 29
Figure 7-2 – Summary of Northeast Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Northeast Region 29
Figure 7-3 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Southeast Region 32
Figure 7-4 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Southeast Region 32
Figure 7-5 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Pacific Region 35
Figure 7-6 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Pacific Region 35
Figure 7-7 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Inland Region 38
Figure 7-8 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Inland Region 38
Figure 7-9 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the National Survey 41
Figure 7-10 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the National Survey 41

Tables

Table 2-1—Definitions of Policy Attributes and Baseline (Status Quo) Values Included Across Survey Versions 12
Table 3-1—Attribute Levels Assigned Across Policy Options and Survey Versions 15
Table 5-1—Target Sample Sizes and Geographic Stratification Design 20
Table 6-1—Completed Surveys Received and Response Rates by Survey Version 21
Table 6-2—Demographic Characteristics of Survey Respondents by Survey Region [a] 22
Table 6-3—Summary of Responses to Questions Regarding Survey Understanding and Bias Across All Survey Regions 23
Table 7-1—Target Sample Sizes for the Non-Response Study by Survey Version 25
Table 7-2—Completed Non-Response Surveys Received and Response Rates by Survey Version and Survey Mode 26
Table 7-3—Demographic Characteristics of the Main and Non-Response Samples for the Northeast Survey Region 28
Table 7-4—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Northeast Region [a,b] 30
Table 7-5—Demographic Characteristics of the Main and Non-Response Samples for the Southeast Survey Region 31
Table 7-6—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Southeast Region [a,b] 33

Table 7-7—Demographic Characteristics of the Main and Non-Response Samples for the Pacific Survey Region 34
Table 7-8—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Pacific Region [a,b] 36
Table 7-9—Demographic Characteristics of the Main and Non-Response Samples for the Inland Survey Region 37
Table 7-10—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Inland Region [a,b] 39
Table 7-11—Demographic Characteristics of the Main and Non-Response Samples for the National Survey Region 40
Table 7-12—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the National Survey Version [a,b] 42
Table 8-1—Summary of Variables Included in the Random Utility Models for the Regional and National Surveys 44
Table 8-2—Subgroups Included within the Northeast and Southeast Weighted Models [a,b] 47
Table 8-3—Subgroups Included within the Pacific Weighted Model 47
Table 8-4—Weighting Targets Used for the Inland and National Survey Versions [a] 48
Table 8-5—Results for the Northeast Region 51
Table 8-6—Results for the Southeast Region 52
Table 8-7—Results for the Pacific Region 53
Table 8-8—Results for the Inland Region 54
Table 8-9—Results for the National Survey Version 55
Table 8-10—Results of the Split-Sample External Validity Test for the Northeast Survey Data [a] 57
Table 8-11—Results of the Split-Sample External Validity Test for the Southeast Survey Data 58
Table 8-12—Results of the Split-Sample External Validity Test for the Pacific Survey Data 59
Table 8-13—Results of the Split-Sample External Validity Test for the Inland Survey Data 60
Table 8-14—Results of the Split-Sample External Validity Test for the National Survey Data 61
[redacted]
Table 9-1—Estimated Implicit Prices for a One Percentage Point Change in Each Attribute, WTP per household, per Year (2011$) 67
[redacted]
Table 10-1—Reduction in A1E Losses and Fish Saved (%) by Survey Version and Regulatory Option .. 71
Table 10-2— WTP per Household per Year by Regulatory Option (2011$) 72
[redacted]

Acronyms

A1E	Age-1 equivalent
ACS	American Community Survey
AIF	Actual intake flow
ASC	Alternative specific constant
BSPV	Bioindicator-Based Stated Preference Valuation
BTA	Best technology available
CWIS	Cooling water intake structure
DSF	Delivery Sequence File
EEBA	Environmental and Economic Benefits Analysis
I&E	Impingement and entrainment
IBIs	Indices of Biotic Integrity
ICR	Information Collection Request
[redacted]	
MGD	Millions of gallons per day
MSY	Maximum sustainable yield
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
SP	Stated preference
STAR	Science to Achieve Results
T&E	Threatened and Endangered
WTP	Willingness to pay

1 Introduction

1.1 Purpose of the Section 316(b) Regulations

The withdrawal of cooling water from streams, rivers, estuaries, and coastal marine waters by cooling water intake structures (CWISs) causes adverse environmental impacts to aquatic biota and communities in these water bodies. These impacts are caused through several means, including impingement mortality (where fish and other aquatic life are trapped on equipment at the entrance to the CWIS) and entrainment mortality (where aquatic organisms, including eggs and larvae, are taken into the cooling system, passed through the heat exchanger, then discharged back into the source body). Together, they are referred to as impingement and entrainment (I&E) mortality. Additional adverse effects are often associated with CWIS operation, including nonlethal effects of impingement, thermal discharges, chemical effluents, flow modifications caused by these plants, and other impacts of variable and unknown magnitudes.

The Section 316(b) regulations would establish national performance requirements for the location, design, construction, and capacity of CWISs (Clean Water Act 1972). The regulations are designed to minimize the adverse environmental impacts caused by CWIS through reduction of volume, frequency, and/or seasonality of water withdrawals. The regulations would significantly reduce I&E mortality, as well as reduce the magnitude of other impacts (i.e., thermal, chemical, and flow alteration) on aquatic ecosystems. Thus, changes in CWIS design or operation resulting from Section 316(b) regulations are likely to result in enhanced ecosystem function and increased ecological services provided by affected water bodies. Executive Orders 12866 and 13563 require EPA to estimate the potential benefits and costs of the rulemaking to society.

1.2 Legal History of the Section 316(b) Regulations

In 1995, EPA entered into a consent decree (later amended) with Riverkeeper and a coalition of other individuals and environmental groups that set three phases for the issuance of 316(b) regulations. Phase I applied to new facilities, Phase II applied to existing electric generation facilities withdrawing more than 50 million gallons per day (MGD) with at least 25% of the water exclusively used for cooling purposes, and Phase III addresses other existing facilities, as well as new offshore and coastal oil and gas extraction facilities that are designed to withdraw two or more MGD with at least 25% of the water exclusively used for cooling purposes.

The Phase I Rule was issued in 2001. In February 2004, EPA took final action on the Phase II Rule governing cooling water intake structures at existing facilities that are point sources. Industry and environmental stakeholders challenged the Phase II Rule, and following judicial review, the Second Circuit (Riverkeeper, Inc. v. EPA, 475 F.3d 83 (2d Cir., 2007)) remanded several parts of the Phase II Rule. The Court ruled that EPA improperly used a cost-benefit analysis as a criterion for determining Best Technology Available (BTA), and that EPA inappropriately used ranges in setting performance expectations. The Second Circuit further ruled that restoration was not permissible as BTA, and that EPA's cost-benefit, site-specific compliance alternative was not in accordance with the Clean Water Act. In response, EPA suspended the Phase II regulations in July 2007 pending further rulemaking. In response to a petition by Entergy Corporation, the U.S. Supreme Court issued a writ of certiorari instructing the Second Circuit to send the case record of Riverkeeper, Inc. v. EPA to the Court for review of the cost-benefit decision. On April 1, 2009, in Entergy Corp. v. Riverkeeper Inc., the Court decided, "EPA permissibly relied on cost-benefit analysis in setting the national performance standards … as part of the Phase II regulations." EPA took a voluntary remand of the rule, thus ending Second Circuit review.

In June 2006, EPA promulgated the 316(b) Phase III Rule for existing manufacturers, small-flow power plants, and new offshore oil and gas facilities. Small-flow power plants are facilities that use cooling water intake structures with a total design intake flow of less than 50 MGD to withdraw cooling water from waters of the United States, and use at least 25% of the withdrawn water exclusively for cooling purposes. Offshore oil and gas firms, as well as environmental groups, petitioned for judicial review, which occurred in the Fifth Circuit. EPA voluntarily remanded the existing facilities portion of the Phase III rulemaking, and combined the two phases into one rulemaking, known as the Existing Facilities Rule (Phase IV), which covers all existing facilities. In March 2011, EPA proposed regulations for the Existing Facilities Rule.[1]

1.3 Analysis for the Proposed 316(b) Existing Facilities Rule

EPA's analysis for the 316(b) proposed rule, released in March 2011, included estimates of changes in use values of commercial and recreational fisheries and only a partial estimate of changes in non-use values (USEPA 2011a).[2,3] The Agency estimated commercial fishing benefits based on changes in producer surplus from increased commercial harvest. Recreational fishing benefits were based on a benefits transfer from a meta-analysis of willingness to pay (WTP) for catching an additional fish per trip.[4] EPA was able to estimate changes in non-use values for only two of the seven study regions due to limitations in the available valuation studies. To estimate changes in non-use values, EPA developed a benefits transfer approach using an existing stated preference (SP) study conducted by Johnston et al. (2011a, b) that is closely related to the 316(b) policy context.[5] EPA was unable to estimate non-use values for the other five regions.[6]

After the proposed rule was released, EPA conducted an SP study (EPA Information Collection Request (ICR) #2402.01) to estimate total (use plus non-use) benefits of the ecological gains from the regulation of cooling water intake structures at NPDES-permitted facilities. The use of an SP survey reflects recent EPA guidelines for benefits analysis (USEPA 2010, p. 7-41) that recognize the "advantages of [stated preference] methods include[ing] their ability to estimate non-use values and to incorporate hypothetical scenarios that closely correspond to a policy case."[7]

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1 Additional information on the rule is available on EPA's website at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm.

2 Non-use values area values that people may hold for an environmental improvement that are not tied to any use of the resource such as recreation.

3 The Environmental and Economic Benefits Analysis (EEBA) for the proposed rule is available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/upload/environbenefits.pdf.

4 Threatened and endangered (T&E) and other special status species can be adversely affected in several ways by CWISs. EPA applied benefits transfer to estimate recreational values for a subset of T&E species for which limited catch and release fisheries exist.

5 Benefits transfer is the "practice of applying nonmarket values obtained from primary studies of resource or environmental changes undertaken elsewhere to the evaluation of a proposed or observed change that is of interest to the analyst" (Freeman 2003, p.453).

6 Refer to Chapter 8 of the Environmental and Economic Benefits Analysis (USEPA 2011a) for additional description of the benefits transfer approach used for the proposed rule.

7 SP surveys are a type of non-market valuation method used, in this case, to measure values associated with ecosystem improvements, as reflected in households' willingness to pay (WTP). The values individuals hold for ecosystem improvements are estimated by analyzing the selections that respondents make between hypothetical policy options and current conditions.

The 316(b) SP survey was conducted as a choice experiment with four regional versions (Northeast, Southeast, Inland, and Pacific) and a national version. In July 2011, The Office of Management and Budget (OMB) approved implementation of the Northeast survey version as a pilot study implemented in advance of other versions to inform potential changes to other survey versions. This implementation plan is described in the ICR for the 316(b) SP survey (EPA ICR #2402.01) and followed recommendations in published guidance for SP survey design (Arrow et al. 1993; Bateman et al. 2002). OMB approved implementation of the remaining survey versions in November 2011.EPA has completed fielding the main study and non-response studies. EPA also conducted a non-response study for each version of the survey, to learn whether respondents are fundamentally different from non-respondents. EPA used regression models to estimate annual household willingness to pay (or implicit price) for a one percentage point improvement in environmental attributes included in the survey (fish saved, commercial fish populations, fish populations (all fish), and aquatic ecosystem condition). The results of the non-response study enabled EPA to reduce the weight placed on overrepresented respondent groups, while increasing the weight placed on underrepresented respondent groups. EPA also used the implicit prices to estimate the regional and national benefits of the regulatory options presented in the proposed rule documentation.

2 Choice Experiment Framework

SP surveys generally ask questions that elicit individuals' stated values for carefully specified changes in an environmental amenity (Freeman 2003). This value is typically estimated in terms of WTP, defined as the maximum amount of money (or some other commodity) that an individual or household would be willing to give up in exchange for a specified environmental change, rather than go without that change. Various question formats have been used in the SP literature to elicit WTP. Some types of SP surveys ask respondents to reveal their WTP using open-ended questions, payment cards, or bidding games. Increasingly, however, these original types of SP surveys have been replaced in the literature by methods grounded in random utility models (Hanemann 1984) in which respondents express their WTP through choices over hypothetical policy options. Advantages of these choice-based methods include similarity to familiar referenda or market choice contexts, in which individuals choose among alternative policy options or commodities at different costs (Freeman 2003), although responses to hypothetical choice questions are still not actual market transactions or referenda. Appropriately designed choice-based SP methods may also reduce strategic, hypothetical, and other possible biases that can result from asking survey questions versus assessing WTP through market transactions or binding referenda.

Substantial research has been conducted over the past two decades on hypothetical bias in SP surveys. While many studies have found evidence of hypothetical bias (List and Gallet 2001), a recent meta-analysis indicates that "hypothetical bias in SP studies may not be as important" as some have argued previously (Murphy et al. 2005), mirroring similar findings in prior studies that compare hypothetical and actual referenda (see discussion in Johnston 2006). Results of these recent meta-analyses and other work also demonstrate that the extent of hypothetical bias in SP research is determined by the specific attributes of the survey, affected commodities, consequentiality, type of welfare estimate, and other factors (e.g., Murphy et al. 2005; List and Gallet 2001; Johnston 2006). These results suggest that it is not possible to draw general conclusions about the magnitude of hypothetical bias in SP surveys. The presence or extent of hypothetical bias in any SP result is determined by the attributes of the individual research methods applied. For the present survey, EPA has incorporated a variety of elements in an effort to mitigate hypothetical and other possible biases.

The 316(b) survey was designed as a choice experiment following established choice experiment methodology and format (Adamowicz et al. 1998; Louviere et al. 2000; Bennett and Blamey 2001;

Bateman et al. 2002). Choice experiments, also called choice models, are an SP technique in which people's values are estimated based on their choices over a set of hypothetical but realistic policy options. Under the choice experiment (or choice modeling) format, respondents are presented with a set of multi-attribute alternatives and asked to select their preferred alternative, much as one might choose a preferred option in a public referendum. This format has been applied to assess WTP for ecological resource improvements of a type similar to those at issue in the 316(b) policy case (e.g., Bennett and Blamey 2001; Hanley et al. 2006a, b; Hoehn et al. 2004; Johnston et al. 2002, 2011a, b; Milon and Scrogin 2006; Morrison and Bennett 2004; Morrison et al. 2002; and Opaluch et al. 1999). The Northeast version of the 316(b) survey is presented in Appendix A of this document as an example.

Advantages of these choice-based methods include similarity to familiar referenda or market choice contexts, in which individuals choose among alternative policy options or commodities at different costs (Freeman 2003). Choice experiments allow survey respondents to express WTP for a wide range of different potential outcomes of 316(b) policies, differentiated by their attributes.[8] This enables EPA to isolate the marginal effects of different possible policy outcomes on stated choices, and hence on estimated WTP, thereby estimating benefits for a wide range of potential policy outcomes. This is a primary factor distinguishing choice experiments from older forms of SP analysis, in which estimated WTP is typically contingent upon a single specification of ecological effects. The goal of the choice experiment is to collect data which can be used to estimate regression coefficients from mixed or conditional logit models for estimating WTP for multi-attribute policy alternatives, or the likelihood of choosing a given multi-attribute alternative, following standard random utility modeling procedures (Haab and McConnell 2002; Train 2009).

Following standard choice experiment (or choice modeling) format (Adamowicz et al. 1998; Bennett and Blamey 2001), EPA asked respondents to consider three potential policies, or choice options—Policy Option A (*A*), Policy Option B (*B*), and No Policy (current situation) (*N*)—choosing the option that they most preferred; in other words, that provided the highest utility. Each choice option reflected a hypothetical but feasible outcome under alternative 316(b) regulatory scenarios. Figure 2-1 is an example of a choice experiment question from the Northeast survey.[9] Respondents could also choose to reject both policies and retain the status quo. The "no policy" or status quo option was included in the visible choice set following guidance from the literature, to ensure that WTP measures are well-defined (Louviere et al. 2000). The underpinning theoretical model was adapted from a standard random utility specification in which household *h* chooses among three choice options, (*j= A, B, N*), including two multi-attribute policy options (*A, B*) and a fixed "no policy" status quo (*N*) that includes no policy changes and zero household cost. Following standard practice (Day et al. 2012; Poe et al. 1997; Layton 2000), EPA presented respondents with more than one choice question within the same survey. Other questions in the survey elicited information including whether the respondent was a user of the affected aquatic resources, household income, and other respondent demographics.

As shown in Figure 2-1, the effects of the policy options were described in terms of an annual household cost incurred indefinitely and four environmental endpoints, or attributes: (a) commercial fish populations, (b) fish populations (all fish), (c) fish saved, and (d) condition of aquatic ecosystems. Values were reflected in the survey by individuals' willingness to "vote" for policies that would increase their

[8] Choice experiments following the random utility model are favored by many researchers over other variants of SP methodology (Adamowicz et al. 1998; Bennett and Blamey 2001), and may be viewed as a "natural generalization of a binary discrete choice CV [contingent valuation]" (Bateman et al. 2002, p. 271).

[9] A choice question from the Northeast survey is included here as an example. The question format was identical for all survey versions (Northeast, Southeast, Pacific, Inland and national).

cost of living, in exchange for specified changes in the four environmental attributes. The definitions of the five attributes used to characterize policies are presented in Table 2-1. Table 2-1 also presents the baseline (status quo) attribute values included across survey versions. The regional versions (Northeast, Southeast, Inland, and Pacific) presented policy options and attribute values specific to the respondent's region, while the national survey presented policy options and attribute values for all U.S. waters. Version 1 of the Northeast survey is presented in its entirety in Appendix A of this document. Differences between the survey versions are discussed in Section 3.

Question 4. Assume that Options A and B would require a different mix of filters and closed cycle cooling in different areas. Assume all types of fish are affected. How would you vote?

Policy Effect NE Waters	Current Situation (No policy)	Option A	Option B
 Commercial Fish Populations (in 3-5 Years)	42% (100% is populations that allow for maximum harvest)	45% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)
 Fish Populations (all fish) (in 3-5 Years)	26% 100% is populations without human influence)	30% (100% is populations without human influence)	27% (100% is populations without human influence)
 Fish Saved per Year (Out of 1.1 billion fish lost in water intakes)	0% No change in status quo	5% <0.1 billion fish saved	5% <0.1 billion fish saved
 Condition of Aquatic Ecosystems (in 3-5 Years)	50% (100% is pristine condition)	52% (100% is pristine condition)	54% (100% is pristine condition)
$ Increase in Cost of Living for Your Household	$0 No cost increase	$48 per year ($4 per month)	$48 per year ($4 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I would vote for NO POLICY	☐ I would vote for OPTION A	☐ I would vote for OPTION B

11

Figure 2-1 – Example Choice Experiment Question from the Northeast Survey

Table 2-1—Definitions of Policy Attributes and Baseline (Status Quo) Values Included Across Survey Versions

Attribute	Definition	Northeast	Southeast	Pacific	Inland	National
Commercial Fish Populations	A score between 0% and 100% showing the overall health of commercial and recreational fishing populations. High scores mean more fish and greater fishing potential. A score of 100 means that these fish populations are at a size that maximizes long-term harvest: 0 means no harvest.	42%	39%	56%	39%	51%
Fish Populations (All Fish)	A score between 0% and 100% showing the estimated size of all fish populations compared to natural levels without human influence. A score of 100 means that populations are the largest natural size possible; 0 means no fish.	26%	24%	32%	33%	30%
Fish Saved (per Year)	A score between 0% and 100% showing the reduction in young fish lost compared to current levels. A score of 100 would mean that no fish are lost in cooling water intakes (all fish would be saved because of the new policy).	0%	0%	0%	0%	0%
Condition of Aquatic Ecosystems	A score between 0% and 100% showing the ecological condition of affected areas, compared to the most natural waters in the region. The score is determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions.	50%	68%	51%	42%	53%
Cost per Year	How much the policy will cost your household, in unavoidable ongoing price increases for products and services you buy, including electricity and common household products.	$0	$0	$0	$0	$0

The four environmental attributes were designed based on the Johnston et al. (2011a, b; 2012) Bioindicator-Based Stated Preference Valuation (BSPV) method, which was developed to promote ecological clarity and closer integration of ecological and economic information within SP studies. Johnston et al. (2011a, b; 2012) was an EPA Science to Achieve Results (STAR) grant project. The BSPV method's focus on improved ecological valuation is an EPA priority as described in findings of EPA's Science Advisory Board Committee on Valuing the Protection of Ecological System and Services (USEPA 2009). BSPV employs a more structured and formal use of ecological indicators to characterize and communicate welfare-relevant changes. The welfare measures provided by the BSPV method are designed to be unambiguously linked to models and indicators of ecosystem function, grounded in measurable ecological outcomes, and more easily incorporated into benefit cost analysis. Specific BSPV guidelines aim to ensure that survey scenarios and resulting welfare estimates are characterized by (1) a formal basis in established and measurable ecological indicators, (2) a clear structure linking these indicators to attributes influencing individuals' well-being, (3) consistent and meaningful interpretation of ecological information, and (4) a consequent ability to link welfare measures to measurable and unambiguous policy outcomes.

EPA estimated the commercial fish population score based on the average ratio of fish population to maximum sustainable yield (MSY) among commercially harvested species including commercially harvested species with stock assessment reports conducted by a reputable body such as the National Oceanic and Atmospheric Administration (NOAA) or the Atlantic States Marine Fisheries Commission. For commercially targeted fish, "natural" population was calculated as a scalar multiple of MSY; an unharvested population is typically believed to be approximately three times as large as MSY. The score was calculated by comparing the baseline population to this estimate of natural populations averaged across all species to obtain regional values. Changes in scores under regulatory options can be calculated by modeling commercial fish populations with implementation of the rule and comparing to natural populations.

The baseline value for "fish saved" is 0% for all regions, which reflects the status quo level of I&E mortality before the implementation of regulatory options. The estimates of "fish saved" due to 316(b) facilities at baseline are based on EPA's estimate of age-1 equivalent (A1E) losses, a metric used by EPA to standardize all I&E mortality losses into equivalent numbers of 1-year-old fish. This conversion allows losses to be compared among species, years, facilities, and regions. To obtain regional I&E mortality estimates, EPA extrapolated loss rates from facilities for which I&E mortality data are available (referred to as model facilities) to all in-scope facilities within the same region. Refer to Section 3 of the Environmental and Economic Benefits Analysis (EEBA) of the proposed rule (USEPA 2011a) for additional detail on EPA's assessment of baseline A1E losses and reductions in A1E losses under regulatory options. The introductory materials describe the age classes impacted due to cooling water intakes, and the "fish saved" attribute is defined as "young fish lost compared to current levels." While the A1E terminology was not used specifically within the SP survey, pre-testing during focus groups and cognitive interviews indicated that participants understood the "fish saved" attribute and the concept of "young fish" as reflecting initial losses of eggs and other juvenile life stages. Additional detail on focus group findings can be found in the executive summary of the report entitled "Executive Summary of Findings from2010 Focus Groups Conducted Under EPA ICR #2402.01" (Besedin and Stapler 2011), which has been provided as a separate document. Section 1.2 of the executive summary addresses interpretation of information by respondents. The full report on focus group findings is available upon request.

The baseline fish populations (all fish) score was calculated in a fashion similar to the commercial fish population score based on species with population estimates published in the literature including commercially or recreationally harvested species with stock assessment reports and threatened species with assessment reports. Current populations were compared to estimates of natural population size "without fishing." For regulatory options, changes in fish populations can be modeled with compliance and compared to natural populations.

EPA estimated the baseline values for the aquatic ecosystem score, by identifying studies in a region that apply or define various multimetric indices of water quality, such as Indices of Biotic Integrity (IBIs) from the published literature or from state reports. EPA took a wide geographic sampling of these indices, converted the aquatic scores to values between 0 and 100, and averaged across all indices within the region to obtain regional mean values. Changes under the regulatory options can be evaluated based on changes in the multimetric indices.

3 Experimental Design

Following established practices, EPA used an experimental design to generate multiple unique combinations of policy options for different respondents to compare. Respondents were presented with

three separate policy questions in the survey, each with a unique combination of policy options. The experimental design specifies how attribute levels were "mixed and matched" within choice questions, thereby developing an empirical data framework with appropriate statistical properties to allow for analysis of respondents' choices (Louviere et al. 2000).

EPA applied a fractional factorial experimental design representing a subset of all possible combinations of environmental attributes and household cost, allowing for efficient estimation of particular effects of interest (Louviere et al. 2000) and reducing the cognitive burden faced by respondents (Holmes and Adamowicz 2003). EPA used the experimental design to construct choice questions with an orthogonal (independent) array of attribute levels, with questions randomly divided among distinct survey versions (Louviere et al. 2000). The fractional factorial experimental design was generated using a D-efficiency criterion for main effects estimation (Kuhfeld 2010; Kuhfeld and Tobias 2005). A more efficient design enables model coefficients (and hence estimated WTP) to be estimated with greater precision (i.e., lower standard errors or variability) for any given number of observations. It also minimizes correlation between attributes across survey questions (i.e., attributes do not "move together" across different survey questions), so that the unique effect of each attribute on respondents' choices can be isolated.[10]

The attribute levels included across option pairs in the survey versions are summarized in Table 3-1. As described in Section 2, each choice question includes two choice options (Option A and Option B), characterized by the five attributes in Table 2-1 with values differing between the two choice options. The resulting experimental design is characterized by 72 unique Option A versus Option B pairs, each corresponding to a choice question defined by an orthogonal array of attribute levels for the two policy options. Following guidance from the literature, EPA designed the attribute to illustrate realistic policy scenarios that "span the range over which we expect respondents to have preferences, and/or are practically achievable" (Bateman et al. 2002, p. 259). Choice scenarios represent each ecological attribute in relative terms with regard to upper and lower reference conditions (i.e., best and worst possible in the affected area), as defined in survey informational materials. The survey also presents the cardinal basis for relative scores where applicable, e.g., change in fish saved per year is illustrated both in terms of numbers of age-1 equivalent fish and in terms of a percentage of current estimated mortality. Relative scores represent percent progress toward the upper reference condition (100%), starting from the lower reference condition (0%). This approach is based on BSPV methods of Johnston et al. (2011a, b; 2012).

As described above, the experimental design for each of the four regional and national surveys is characterized by 72 unique A vs. B option pairs. Each pair represents a unique choice modeling question, with a unique set of attribute levels distinguishing Options A and B. It is standard practice to include more than one choice question in each survey, increasing the information obtained from each respondent (Poe et al. 1997; Layton 2000); this has been described as a "fundamental element of … choice experiments" (Day et al. 2012, p. 73). EPA randomly assigned the 72 option pairs to 24 distinct survey booklets for each of the four regional and the national surveys, with three option pairs (i.e., choice questions) per survey booklet. All 72 profiles (unique sets of choice options) included in each of the four regional and national survey versions are presented in Appendix B. The 24 versions of the booklets for each of the regional and the national surveys were randomly assigned to households in the mail sample.

Focus groups showed that respondents react negatively and often protest when offered choices in which one policy option dominates the other in all attributes. Following guidance from the literature (Hensher

[10] EPA removed dominated pairs where one option is superior to the other in all attributes. Focus groups showed that respondents react negatively and often protest when offered dominated pairs. Given that such choices provide negligible statistical information compared to choices involving non-dominated pairs, they are typically avoided in statistical designs of choice experiments.

and Barnard 1990), EPA constrained the design to eliminate such dominant/dominated pairs. EPA also eliminated non-credible pairs where one of the options offers both a greater reduction in fish losses and a smaller increase in the population in order to avoid protest bids and confusion among respondents (Bateman et al. 2002), also based on the result of focus groups.

Table 3-1—Attribute Levels Assigned Across Policy Options and Survey Versions

Attribute	Baseline (Status Quo)[a]	Max Change Assigned	Attribute Levels Assigned to Option A vs. Option B Pairs					
			1	2	3	4	5	6
Commercial Fish Populations *(Score showing the overall health of commercial and recreational fish populations)*								
Northeast	42%	6%	43%	45%	48%	-	-	-
Southeast	39%	6%	40%	42%	45%	-	-	-
Pacific	56%	6%	57%	59%	62%	-	-	-
Inland	39%	6%	40%	42%	45%	-	-	-
National	51%	6%	52%	54%	57%	-	-	-
Fish Populations (all fish) *(Score showing the estimated size of all fish populations compared to natural levels without human influence)*								
Northeast	26%	4%	27%	28%	30%	-	-	-
Southeast	24%	4%	25%	26%	28%	-	-	-
Pacific	32%	4%	33%	34%	36%	-	-	-
Inland	33%	4%	34%	35%	37%	-	-	-
National	30%	4%	31%	32%	34%	-	-	-
Fish Saved per Year *(Score showing the reduction in young fish lost compared to current levels)*								
Northeast	0%	95%	5%	50%	95%	-	-	-
Southeast	0%	90%	25%	55%	90%	-	-	-
Pacific	0%	95%	2%	50%	95%	-	-	-
Inland	0%	95%	55%	75%	95%	-	-	-
National	0%	95%	25%	55%	95%	-	-	-
Aquatic Ecosystem Condition *(Score showing the ecological condition of affected areas, compared to the most natural waters in the region)*								
Northeast	50%	4%	51%	52%	54%	-	-	-
Southeast	68%	4%	69%	70%	72%	-	-	-
Pacific	51%	4%	52%	53%	55%	-	-	-
Inland	42%	4%	43%	44%	46%	-	-	-
National	53%	4%	54%	55%	57%	-	-	-
Household Costs *(The increase in annual household cost, in unavoidable price increases)*								
Northeast	$0	$72	$12	$24	$36	$48	$60	$72
Southeast	$0	$72	$12	$24	$36	$48	$60	$72
Pacific	$0	$72	$12	$24	$36	$48	$60	$72
Inland	$0	$72	$12	$24	$36	$48	$60	$72
National	$0	$72	$12	$24	$36	$48	$60	$72

[a] Each question includes a "no policy" option, characterized by the baseline levels for each attribute and a household cost of $0.

4 Pre-Tests and Pilot Tests

Following recommended methods for SP survey design (cf. Arrow et al. 1993; Bateman et al. 2002; Bennett and Blamey 2001; Kaplowicz et al. 2004), EPA pre-tested the survey during 6 focus groups, with 8 to 10 participants each, and a set of 8 one-on-one cognitive interviews (EPA ICR #2090-0028); these

were in addition to an earlier set of 12 focus groups conducted on a prior version of the survey (see additional details below). Each focus group was conducted following standard, accepted practices in the SP literature, as outlined by Mitchell and Carson (1989), Desvousges et al. (1984), Desvousges and Smith (1988), and Johnston et al. (1995). Each cognitive interview included one participant, allowing for in-depth exploration of the cognitive processes used by respondents to answer survey questions, without the potential for interpersonal dynamics to sway respondents' comments (Kaplowicz et al. 2004). Focus groups and cognitive interviews also included questions following the verbal protocols suggested by Schkade and Payne (1994), in which respondents were asked to talk through the process used to answer choice questions. They were conducted in several regions to account for the potentially distinct information relevant to survey design. Additional detail on focus group findings can be found in the executive summary of the report entitled "Executive Summary of Findings from2010 Focus Groups Conducted Under EPA ICR #2402.01" (Besedin and Stapler 2011), which has been provided as a separate document. The full report on focus group findings, including transcripts, is available upon request.

Participants in focus groups and cognitive interviews completed draft survey questionnaires and provided comments and feedback on concerns such as whether (1) questions and survey information were readily understood; (2) respondents were interpreting questions similarly to how EPA interprets them; (3) responses or survey interpretations showed any evidence of heuristics or survey biases, including hypothetical bias; (4) respondents were addressing choice questions in a manner commensurate with utility maximization and neoclassical WTP estimation; and (5) respondents were following instructions provided in the survey instrument and responding to questions accordingly. In addition, early rounds of focus groups were used to identify the primary policy outcomes (i.e., ecological effects of reductions in I&E) over which respondents held preferences, the underlying rationale for these preferences, and the most effective means of communicating utility-relevant outcomes.

Responses to the survey choice questions from participants in the focus groups and cognitive interviews could not be included in model estimation because the draft surveys completed during pre-testing differed somewhat from the final survey. EPA modified the survey several times, based on the results of these pre-tests, to minimize potential biases, and to ensure shared and accurate interpretation of survey language among the respondents.

Results from focus groups and cognitive interviews provided evidence that respondents would answer the SP survey questions in ways appropriate for SP WTP estimation, and that their responses generally would not reflect the types of biases noted above.[11] Results also suggested the presence of non-use values for the ecological outcomes described in survey scenarios. The amount of pre-testing conducted for SP surveys varies within the literature and tends to be related to the complexity of the survey instrument (i.e., more complex survey instruments addressing complex ecological issues require more pre-testing and subsequent revisions). EPA believes that the amount of time and number of focus groups applied to this survey design compares favorably to SP analyses in the peer-reviewed literature. For example, the number of focus groups and cognitive interviews conducted for the survey exceeds that often encountered in published SP research.

SP surveys also require the provision of information to enable respondents to comprehend the potential implications of their hypothetical choices. For example, in this case, respondents might not have been aware that cooling water intake structures can potentially kill large numbers of fish, eggs, and larvae, or that the vast majority of those organisms are species that provide no consumptive use (e.g., commercial or

[11] For example, participants took the survey questions seriously, indicating that hypothetical bias may not be a significant design issue. Many participants were confident when asked whether their choices would be different if they knew the vote was binding; one participant stated that "*No. It would have been the same actually*."

recreational fishing) to humans. Even if they are aware of this issue in a general way, it is unlikely that most of them will have previously considered what preserving those species is worth to them. Elicitation of informed responses requires the provision of background information to respondents including the general context and scope of the issue. This is particularly important in the present case, given the general lack of familiarity of respondents with the effects of cooling water intake structures; EPA gave this issue extensive attention in focus groups and survey design.

Following standard practices in SP survey design, EPA pre-tested the information provided to respondents in focus groups and cognitive interviews to determine what quantity and types of information respondents needed to feel confident and well-informed in their responses (Besedin et al. 2011). For example, EPA explained in the introductory materials accompanying the four regional and national survey versions that the number of "young adult fish" lost in coastal and fresh waters due to cooling water use (also called "age-1 equivalents") included eggs and larvae. Without this educational material survey respondents might not have realized that reported effects on "fish saved per year" in the valuation questions partially resulted from reduced mortality of eggs and larvae. The presentation of this type of background information, if not properly vetted in the survey instrument development process, could result in focusing respondent attention on particular environmental amenities to the exclusion of other market and non-market goods that may also be important to some respondents' decision making with regard to the choice questions.

The final survey instrument built upon an earlier version initially developed as part of the Phase III 316(b) rulemaking. EPA conducted 12 focus groups for the Phase III survey, which was peer reviewed in January 2006 (Versar 2006). See EPA ICR #2155.01 for details. The current survey incorporated both the results of prior focus groups and recommendations received from that peer review panel.[12]

Consistent with established best practices for SP surveys, EPA sought to minimize possible biases by careful and thorough construction and testing of the survey instrument. The Agency recognizes that potential biases may still have remained and may have influenced the results of the study, and that it is impossible to entirely eliminate the possibility of all foreseeable biases, among all respondents. While EPA believes that the study has incorporated current best professional practice in the conduct of SP studies, EPA acknowledges that the results of any empirical study depend on the methodology applied.

5 Sampling Design and Sample Frame

The SP study was designed as a mail survey sent to households in different regions throughout the country. The target population for the SP survey was all individuals from continental U.S. households who are 18 years of age or older. The population of households was stratified into four survey regions: Northeast, Southeast, Inland, and Pacific. These regions were defined by state boundaries and differed from the 316(b) benefits regions used in the EEBA for the proposed rule. Alaska and Hawaii were excluded because they include only four in-scope non-recirculating facilities, represent a small percentage of overall household population, and are separated geographically from the states in each survey region. EPA also administered a national version of the survey that did not require stratification. See Table 5-1 for a list of states included in each survey region.

The survey instrument and sampling were designed to maximize the response rate and minimize the potential non-response bias following Dillman's mail survey approach (Dillman et al. 2009). Dillman et al. (2009) is among the most definitive sources for survey logistics management. Under this approach households selected for the mail survey sample were sent a series of mailings:

[12] Transcripts from the previously conducted focus groups for the Phase III analysis are available upon request.

1. *Preview letter:* Respondents received a preview letter notifying the household that it was selected and briefly describing the survey.
2. *First survey mailing:* The survey booklet was sent to selected households 1 to 2 weeks after the preview letter.
3. *Postcard reminder:* A postcard reminder was sent 1 week after the first survey mailing.
4. *Second survey mailing:* The survey booklet was sent to those households that had not responded to the first mailing 3 weeks after the first survey mailing.
5. *Second reminder:* A follow-up letter was sent 1 week after the second survey mailing.

The preview and reminder letters for the Northeast survey region are presented in Appendix C as an example.

EPA developed target sample sizes for each region to provide statistically robust results while minimizing the cost and burden of the survey to individual respondents.[13] The target sample sizes refer to *completed* mail surveys. They are presented in Table 5-1 along with the number of households selected to receive a survey. EPA selected a total target sample of 2,000 completed surveys across all four regional surveys. These 2,000 surveys were allocated across the four regions based on the number of households in each region relative to the total number of households in the continental United States. In addition, a minimum number of completed surveys were required for each region. Monte Carlo experiments indicate that approximately 6 to 12 completed responses are required for each profile in order to achieve large sample statistical properties for choice experiments (Louviere et al. 2000, p. 104, citing Bunch and Batsell 1989). As described previously, the experimental design included 72 option profiles. Following this guidance, the experimental design required 12 completed surveys for each of the 72 profiles for a total of 864 profile responses per region (72×12=864). A minimum of 288 completed surveys were required for each region because each survey version included 3 profiles (864÷3=288). Based on this allocation, the sample sizes ranged from a high of 732 to a low of 288 households. The margin of error for estimated population percentages (e.g., Hispanic or Latino origin) based on these sample sizes ranged from 3.6 to 5.8 percentage points at the 95% confidence level.[14]

Table 5-1 presents the states included in each region, the total number of households in each region, the target number of completed surveys, and the number of surveyed households for each region. The allocation of the 2,000 completed surveys across the four regions resulted in target sample sizes of 417 for the Northeast version, 562 for the Southeast version, 289 for the Pacific version and 732 for the Inland version. The national version of the mail survey had a target sample size of 288 completed surveys. EPA mailed the survey to 7,840 households in total, anticipating a response rate of 30%. The sample for the national survey version was distributed among the study regions based on the percentage of regional survey sample to ensure that respondents to the national survey version were distributed across the

[13] EPA included three choice questions within each survey, to increase information obtained from each respondent. It is standard practice within choice experiment and dichotomous choice contingent valuation surveys to include more than one choice question in each survey (Poe et al. 1997; Layton 2000; Day et al. 2012). Including more than three choice questions may have negatively affected the response rate by increasing burden on respondents, and including fewer would have increased survey costs by requiring additional households.

[14] Margin of error was calculated assuming that the population percentage selecting a specific answer (e.g., "yes") in a binary question was 50% (i.e., worst case scenario). The range of the margin of error (3.6 to 5.8%) is based on the sample sizes for each region. For example, the sample percentage selecting a specific response to a binary question based on a sample of 732 households has a margin of error of plus or minus 3.6% at a 95% confidence level, whereas the sample percentage selecting a specific response based on a sample of 288 households has a margin of error of plus or minus 5.8%.

continental United States. Households were randomly selected from the U.S. Postal Service Delivery Sequence File (DSF). The DSF covers more than 97% of residences in the United States including city-style addresses and PO boxes, and covers single-unit, multi-unit, and other types of housing structures. Responses to the mail survey are discussed in the following section.

Table 5-1—Target Sample Sizes and Geographic Stratification Design

Survey Region	States Included	Household Population	Target Sample Size [a,b]	Number of Survey Versions	Target for each Survey Version [c]	Number of Surveyed Households
Northeast	CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT	23,281,296	417	24	18	1,440
Southeast	AL, FL, GA, LA, MS, NC, SC, TX, VA	31,378,122	562	24	24	1,920
Inland	AR, AZ, CO, ID, IA, IL, IN, KS, KY, MI, MN, MO, MT, ND, NE, NM, NV, OH, OK, SD, TN, UT, WI, WV, WY	40,852,983	732	24	31	2,480
Pacific	CA, OR, WA	16,158,206	289	24	13	1,040
Total for Regional Survey Versions	U.S. (excluding AK and HI)	111,670,607	2,000	-	-	6,880
National Survey Version	U.S. (excluding AK and HI)	111,670,607	288	24	12	960

[a] Target sample sizes presented here refer to *completed* mail surveys.

[b] The sample was allocated to each region in proportion to the total number of households in that region, with at least 288 completed surveys in each region, the number required to estimate the main effects and interactions under an experimental design model.

[c] EPA mailed the same number of each of the 24 versions within each survey region. The "target for each survey version" was calculated by dividing the "target sample size" by 24 and rounding up to the next integer. The result was then divided by 30% (the anticipated response rate) to calculate the "number of surveyed households."

6 Mail Survey Responses

EPA received a total of 2,313 completed mail surveys across all versions. Table 6-1 summarizes the number of completed surveys received and the response rate (minus undeliverable surveys across the survey versions). The average response rate across all versions was 32%. This response rate is generally comparable to various other recent mail surveys in the SP literature (e.g., Hanley et al. 2006a; Johnston and Duke 2009; Johnston and Bergstrom 2011; Boyle and Özdemir 2009). Responses to the mail survey and non-response survey were entered into an electronic database suitable for use with a statistical analysis software package. Table 6-2 provides demographic characteristics of survey respondents in each survey region.

Table 6-1—Completed Surveys Received and Response Rates by Survey Version

Survey Version	Households Surveyed	Undeliverable Surveys	Completed Surveys Received [a,b]	Response Rate [a]
Northeast	1,440	101	421	31%
Southeast	1,920	197	506	29%
Pacific	1,040	255	311	32%
Inland	2,480	65	787	35%
National Survey Version	960	104	288	34%

[a] The number of undeliverable surveys was subtracted from surveys mailed when calculating the response rate for each survey region. Undeliverable surveys are those surveys that were returned to sender. The undeliverable counts also include a total of six cases where EPA received a reply that the resident to which the survey was addressed is deceased.

An initial review of the survey data suggests that respondents evaluated tradeoffs between costs and benefits of policy options presented to them, and did not simply select "no policy" or the same policy option for all three choice questions. The survey data also indicate that WTP is responsive to scope (i.e., the quantity of environmental improvements across different attributes) across numerous dimensions, and according to a variety of tests. Responses also suggest, mirroring results of focus groups, that respondents distinguished between different types of outcomes from 316(b) regulations. As with any mail survey, some respondents did not complete all questions. However, about 90% responded to the choice experiment questions (questions 4, 5, and 6 of the survey), indicating a relatively low degree of item non-response.

EPA does not find evidence of correlations between respondents' choices across policy questions. About 17% of respondents selected "no policy" (i.e., status quo) for all three choice questions, and about 56% of respondents selected a new policy (either Option A or Option B) for all three choice questions. Thus, more than a quarter of respondents made selections of both policy and status quo in their trio of choice questions. Results of this nature indicate that the experimental design (the selection of the attribute values and household costs) correctly spans and brackets the values respondents have for this resource. This feature allows for robust estimates of WTP based on the survey results. If the survey had used lower monthly household costs, it is more likely that a large group of the respondents would have selected Options A or B, making it difficult to distinguish between respondents with positive but low WTP and high WTP. On the other hand, if EPA had used higher monthly costs and most respondents selected the status quo, it would be difficult to distinguish between respondents with zero WTP and those with positive WTP that is below the levels implied in the choice question.

Table 6-2—Demographic Characteristics of Survey Respondents by Survey Region [a]

Statistic	Northeast	Southeast	Pacific	Inland	National
Average age of respondents	54.6	54.3	52.8	53.7	54.2
Percent under 65 [b]	74.6%	74.1%	76.1%	76.3%	72.7%
Percent male respondents	63.9%	62.3%	62.7%	64.6%	60.4%
Percent currently employed	63.6%	59.2%	65.0%	64.4%	60.2%
Percent employed under age 65	76.9%	75.0%	80.3%	76.9%	72.5%
Highest Level of Education					
Less than High School	4.2%	4.4%	1.7%	1.8%	4.7%
High School or Equivalent	15.7%	16.0%	13.6%	16.8%	17.0%
High School +Technical School	10.2%	11.4%	7.5%	13.8%	9.4%
One or More Years of College	23.9%	24.1%	26.4%	24.5%	22.0%
Bachelor's Degree	22.7%	25.8%	28.8%	22.4%	30.7%
Graduate Degree	23.2%	18.3%	22.0%	20.7%	16.2%
Hispanic or Latino Origin	5.1%	9.9%	13.3%	3.4%	7.0%
Racial Category [c]					
American Indian or Alaskan Native	3.1%	3.9%	3.6%	3.2%	3.0%
Black or African American	7.5%	14.7%	3.6%	6.6%	10.2%
Native Hawaiian or Other Pacific Islander	1.3%	0.0%	0.4%	0.5%	1.5%
Asian	5.7%	2.6%	10.9%	2.8%	4.5%
White [d]	86.6%	82.3%	84.7%	91.0%	83.4%
Average Household Size	2.5	2.5	2.6	2.5	2.7
Number of household members 16 or older	2.0	1.9	1.9	1.9	1.9
Total Household Income [e]					
Average	$88,880	$75,588	$96,144	$73,567	$79,496
Standard Deviation	$69,309	$62,618	$71,282	$57,261	$60,972
Consume commercially caught fish or seafood	91.9%	89.3%	90.4%	89.7%	92.0%
Consume recreationally caught fish or seafood	46.4%	59.5%	50.5%	61.0%	57.7%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to 83.21% for 18+ population nationally (excluding HI and AK) based on Census 2010.
[c] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[d] Compares to 74.9% nationally (excluding HI and AK) based on Census 2010. However, the racial categories presented in this table are different from the Census categories. Unlike the Census, EPA does not present a separate category for respondents selecting more than one race. The Census also includes an "other" category, which was not included in the 316(b) stated preference survey.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

Question 8 of the survey asked respondents to rate their understanding of the survey material, confidence in their responses and thoughts on potential bias. Responses to Question 8 are summarized in Table 6-3 and Figure 6-1. The vast majority of respondents selected "strongly agree," "agree" or "neutral," with a small minority selecting "disagree" or "strongly disagree." Their responses indicate that for the most part, respondents understood the survey materials and were confident in their responses.

Table 6-3—Summary of Responses to Questions Regarding Survey Understanding and Bias Across All Survey Regions

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The survey provided enough information for me to make informed choices	5.5%	12.0%	26.9%	43.8%	11.8%
I feel confident about my answers	1.2%	4.2%	21.7%	46.5%	26.5%
Information in the survey was easy for me to understand	3.9%	9.7%	22.4%	43.7%	20.3%
Information in the survey was fair and unbiased	4.8%	8.1%	38.7%	35.3%	13.0%
Questions were easy for me to understand	2.9%	10.9%	20.9%	45.0%	20.3%
I would vote the same way in a public vote	0.9%	1.8%	18.8%	45.0%	33.4%
The effect of the proposed policies depends on many factors	0.9%	1.2%	10.7%	46.7%	40.5%
Future ecological conditions are never 100% guaranteed	0.8%	1.5%	8.5%	39.8%	49.3%

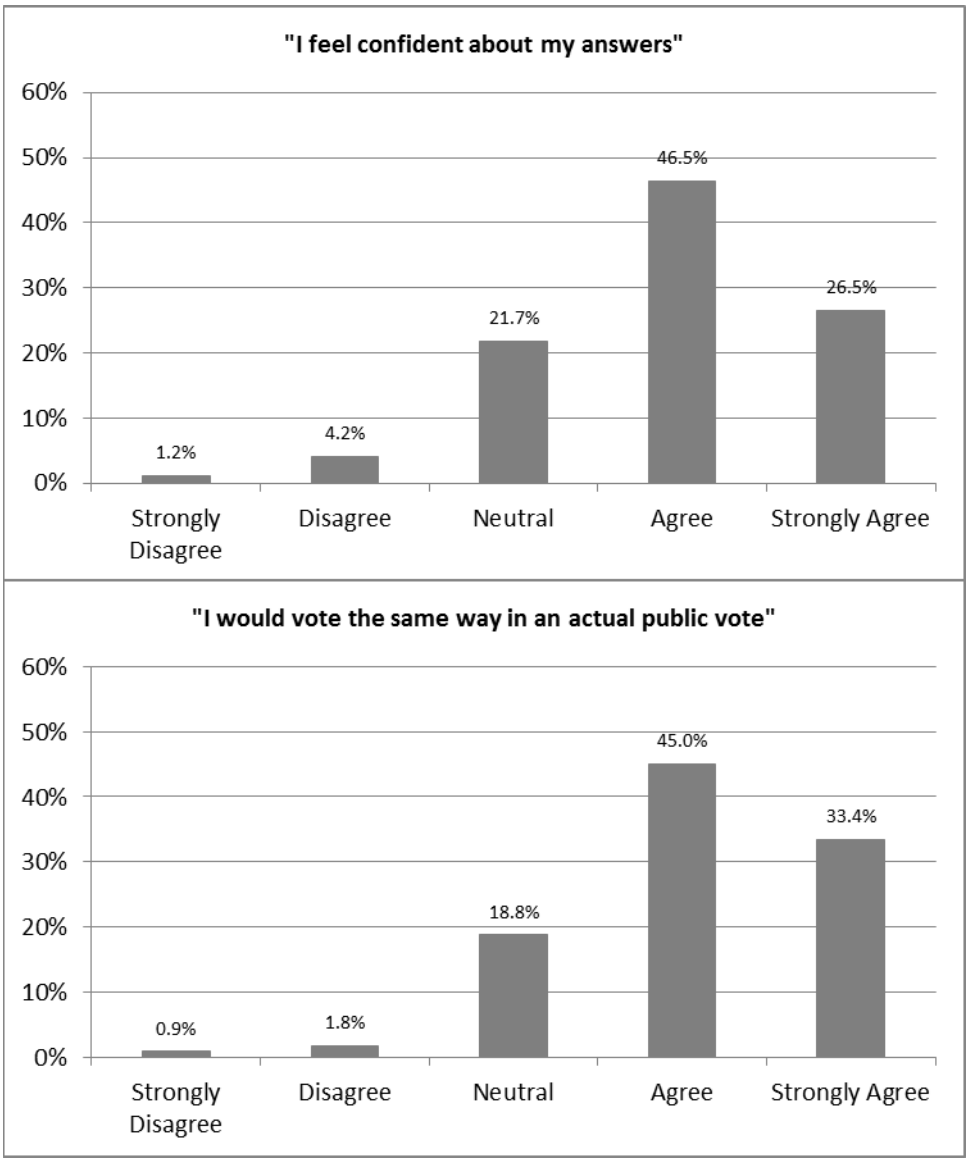


Figure 6-1 – Summary of Responses to Questions Regarding Respondent Confidence Across All Survey Regions

7 Non-Response Study

7.1 Non-Response Study Responses

EPA conducted a follow-up study of households that did not return a completed mail survey to identify whether survey non-respondents are fundamentally different than survey respondents. The follow-up study included a set of key attitudinal questions and socio-demographic variables that are likely to be associated with WTP for reducing fish mortality from cooling water intake structures (CWISs) and improving fish populations and conditions in the affected aquatic ecosystems. EPA implemented the follow-up study using two subsamples: the first subsample received a paper questionnaire via U.S. Postal Service Priority Mail®, and the second subsample was surveyed by telephone. Both non-response subsamples were asked the same set of attitudinal and demographic questions. The Priority Mail non-

response questionnaire is included as Appendix D to this document, and the telephone script is included as Appendix E.[15] It took participants approximately 5 minutes to complete the follow-up study. Responses to the non-response follow-up study were compared statistically to the main mail survey sample to indicate whether there is any evidence of significant differences in attitude and socio-demographic characteristics among survey respondents and non-respondents.

EPA's target sample across all regions for the non-response study was 600 completed questionnaires. This sample size would permit EPA to reject the hypothesis of no difference in population percentages between respondents and non-respondents in characteristics of interest (yes/no type) with 80% power when a two-sided statistical test shows a difference of 12 percentage points. In total, EPA planned to achieve 400 completed surveys in the Priority Mail subsample and 200 completed questionnaires in the telephone subsample. EPA allocated the target non-response completed surveys to each survey region in proportion to the mail survey sample size of each region (see Table 5-1). The resulting non-response targets are presented in Table 7-1.

Table 7-1—Target Sample Sizes for the Non-Response Study by Survey Version

Survey Version	Completed Questionnaires Target		
	Priority Mail Subsample	Telephone Subsample	Total
Northeast	73	36	109
Southeast	98	49	147
Inland	128	64	192
Pacific	51	25	76
National Survey Version	50	25	76

EPA implemented the Priority Mail component in advance of the telephone component for each region. This allowed EPA to include some households in the telephone sample which were mailed, but did not respond to, the Priority Mail non-response questionnaire. Households selected for the Priority Mail subsample were sent a preview letter 1 week in advance of the questionnaire, which included a $2 incentive. EPA randomly selected households for the telephone survey from the subset of households with matched telephone numbers that did not complete the main mail survey or Priority Mail questionnaire. Households selected for the telephone subsample that were not previously sent a Priority Mail questionnaire were sent a preview letter including a $2 incentive 1 week before the first telephone contact attempt. EPA made up to 12 attempts to achieve telephone contacts with the selected households. The preview and cover letters for the non-response study are included in Appendix F as an example.

As described previously, EPA implemented the Northeast mail survey and non-response study in advance of other regions. The Northeast pilot was used to inform sampling and anticipated response rates for other regions. Questionnaires were sent to 146 non-responding Northeast households based on an anticipated 50% response rate (73/0.5). The anticipated response rate was based on prior studies that administered surveys via Priority Mail. EPA actually received 48 completed questionnaires from the Priority Mail

[15] The final version of the non-response follow-up study differs slightly from the version included in the ICR Supporting Statement. The Priority Mail questionnaire was reformatted to support scanning for data entry. Minor edits to the telephone script included clarification of the introductory text, clarification of the approach for selecting which adult household member should participate (most recent birthday), asking the number of household members at the end of the survey rather than the beginning, and revising the income categories to match the main mail survey.

subsample, for a 33% response rate (48/146). Because the Priority Mail response was lower than expected, the target number of telephone completed surveys was increased to obtain the desired number of responses.

EPA randomly selected 331 Northeast households for the telephone survey from the subset of households with matched telephone numbers that did not complete the main mail survey or Priority Mail questionnaire. Fifty-one of the households had been previously sent a completed Priority Mail questionnaire but did not return it. The other 280 households (330-51) were sent a preview letter including the $2 incentive 1 week before the first telephone contact attempt. Up to 12 attempts were made to contact each of the 331 households in the telephone sample. EPA stopped making telephone calls after reaching 63 completed questionnaires among the 331 selected households, for a response rate of 19%.

EPA calculated sample sizes for the remaining four regions assuming response rates of 30% for the Priority Mail subsample and 20% for the telephone subsample based on the results of the Northeast non-response study. The number of completed surveys received and response rates are summarized in Table 7-2 by region and mode. The number of completed surveys exceeds the targets for all survey versions.

Table 7-2—Completed Non-Response Surveys Received and Response Rates by Survey Version and Survey Mode

Survey Version	Priority Mail Subsample			Telephone Subsample			Total Completed	Overall Resp. Rate
	Sample Size	Completed Surveys	Resp. Rate	Sample Size	Completed Interviews	Resp. Rate		
Northeast	146	48	32.9%	331	63	19.0%	111	26.1%
Southeast	297	71	23.9%	410	81	19.8%	152	21.5%
Inland	389	127	32.6%	356	71	19.9%	198	26.6%
Pacific	159	58	36.5%	160	20	12.5%	78	24.5%
National Survey Version	146	58	39.7%	125	22	17.6%	80	29.5%

7.2 Statistical Testing of Mail Survey and Non-Response Data

Responses to the non-response questionnaires were compared statistically to the responses of the main mail survey to determine whether weighting or statistical adjustment was necessary to minimize non-response bias in the main mail survey sample. EPA tested for statistical differences between respondents and non-respondents to the main mail survey for a set of eight key characteristics:

1. *Importance of protecting aquatic ecosystems:* attitudinal question asking the participant to rate how important he or she considers the protection of aquatic ecosystems
2. *Age*: age of the household member completing the survey
3. *Gender*: gender of the household member completing the survey
4. *Education*: highest level of education completed by the household member completing the survey
5. *Employment*: whether the survey participant is currently employed (yes/no)
6. *Hispanic or Latino origin*: whether the participant is of Hispanic or Latino ethnicity (yes/no)

7. *Race*: racial category of the participant
8. *Income*: annual household income.

The first characteristic refers to an attitudinal question included in both the main mail survey and non-response survey. The question asked the participant to rate how important he or she considers the protection of aquatic ecosystems (e.g., "not important," "somewhat important," "very important"). Numbers (2) through (8) are demographic characteristics. Seven of the eight characteristics are either categorical or ordinal variables. For these, EPA tested for statistical differences between the respondents and non-respondents using both the Mann-Whitney U Test and χ^2 Test of Proportions. EPA used the Student's *t*-test for age, the only cardinal variable in the group. EPA considered a variable to be statistically different across the two populations if the null hypothesis of equality could be rejected at $p<0.10$. EPA considered ordinal or categorical variables to be statistically different if the null hypothesis was rejected using either the Mann-Whitney U Test and χ^2 Test of Proportions. Race and income categories were folded into a fewer number of bins for hypothesis testing because few observations are expected for some of the rarer bins, in particular for race (e.g., "Native Hawaiian or Other Pacific Islander"), potentially resulting in significant differences between distributions. Tests for race compare the proportion of the population that is white (versus minority).[16] Tests for income compare the proportion of the population that has household income less than $60,000 (versus greater than $60,000). Also, the income bins included in the survey do not precisely correspond to those available from the American Community Survey (ACS) and Census. The lower or greater than $60,000 categorization can be compared to these national datasets where income weights are deemed necessary based on testing results. This $60,000 level cutoff is also closer to the national median for household income than any other income category included in the survey.[17]

Subsections 7.2.1 to 7.2.5 summarize responses to both the main mail survey and non-response study for each region. Each subsection includes a table summarizing demographic statistics for both the respondent and non-respondent samples. They also include a histogram summarizing responses to the key attitudinal question included in both the main mail survey and non-response survey, which asked participants to rate how important he or she considers the protection of aquatic ecosystem. The non-response survey also included a second question asking participants to rate how involved the government should be in environmental protection (e.g., "not at all involved," "somewhat involved," "highly involved"). Non-respondents' selections for this question are summarized in the second histogram within each subsection.[18] Finally, each subsection includes a table presenting the results of the statistical tests for each of the eight variables. EPA developed model weights for those variables that were found to be statistically different in each region to account for over- and under- represented groups in the mail survey dataset used for model estimation.

7.2.1 Northeast Region (CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, and VT)

Table 7-3 provides demographic characteristics for participants in the Northeast main mail survey and non-response survey. Figure 7-1 summarizes respondent and non-respondent attitudes toward the

[16] Minority (or non-white) respondents were those who selected "American Indian or Alaskan Native," "Black or African American," "Native Hawaiian or Other Pacific Islander," or "Asian," and those who selected more than one racial category.

[17] The national median for household income is $51,914 based on the ACS 5-year estimate for 2006 to 2010.

[18] Multiple questions in the main mail survey asked respondents about their view toward government and environmental protection (e.g., questions 1-5 and 1-6 on page 3 of the mail survey). However, the wording of these questions differed from the question included in the non-response survey, such that they are not directly comparable. The histogram is included here to provide additional information regarding non-respondent attitudes.

importance of protecting aquatic ecosystems. A large majority of respondents to both the main mail survey (90.8%) and non-response study (88.5%) indicated that they consider the protection of aquatic ecosystems to be important; this corresponds to the positive WTP for specific ecological outcomes of 316(b) regulations found in choice experiment results. Figure 7-2 summarizes non-respondents' preferences for government involvement in environmental protection. The vast majority of non-respondents (88.9%) think that the government should be at least somewhat involved in environmental protection, and 39.8% think that it should be highly involved. The statistical testing results in Table 7-4 show that the values for gender and education are statistically different across respondents and non-respondents at $p<0.10$. EPA does not reject the null hypothesis of equality for the remaining demographic variables in the Northeast survey region. "Importance of aquatic ecosystems" is not statistically different across the respondent and non-respondent samples.

Table 7-3—Demographic Characteristics of the Main and Non-Response Samples for the Northeast Survey Region

Statistic	Value/Percentage of Sample [a]	
	Main Mail Sample [b]	Non-Response Sample
Average age of respondents	54.6	53.7
Percent under 65 [b]	74.6%	73.9%
Percent male respondents [c]	63.9%	44.5%
Percent currently employed	63.6%	62.7%
Percent employed under age 65	76.9%	79.3%
Highest Level of Education		
Less than High School	4.2%	4.5%
High School or Equivalent	15.7%	27.3%
High School +Technical School	10.2%	4.5%
One or More Years of College	23.9%	17.3%
Bachelor's Degree	22.7%	27.3%
Graduate Degree	23.2%	19.1%
Hispanic or Latino Origin	5.1%	5.6%
Racial Category [d]		
American Indian or Alaskan Native	3.1%	2.9%
Black or African American	7.5%	11.4%
Native Hawaiian or Other Pacific Islander	1.3%	0.0%
Asian	5.7%	2.9%
White	86.6%	85.7%
Average Household Size	2.5	2.6
Number of household members 16 or older	2.0	2.1
Total Household Income [e]		
Average	$88,880	$81,480
Standard Deviation	$69,309	$68,486
Consume commercially caught fish or seafood	91.9%	84.7%
Consume recreationally caught fish or seafood	46.4%	47.7%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to about 82.1% for 18+ population in Northeast states based on Census 2010.
[c] The population is 47.8% male averaging across the 18+ population in Northeast states, based on Census 2010.
[d] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

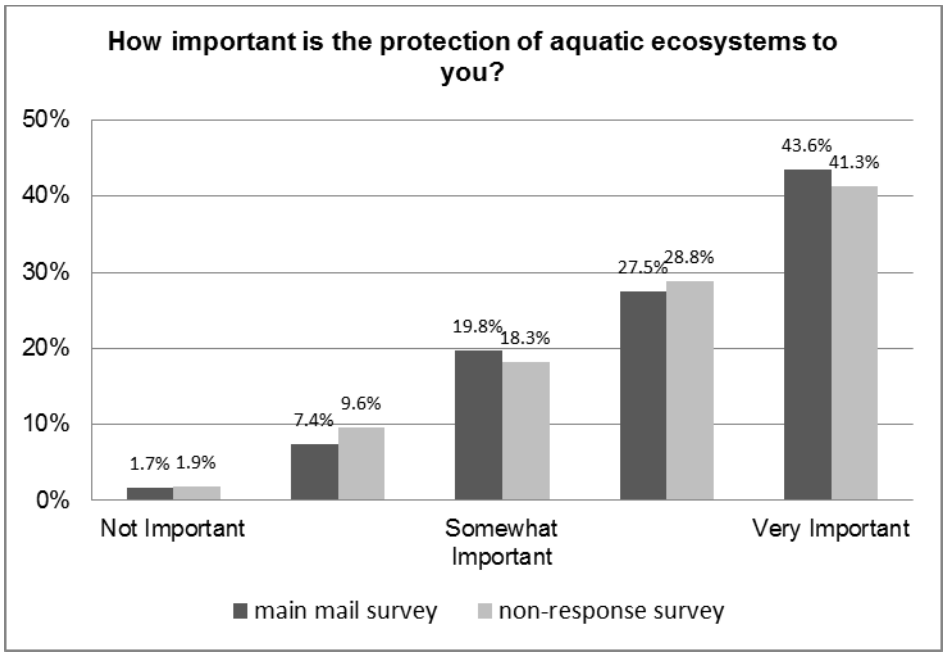


Figure 7-1 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Northeast Region

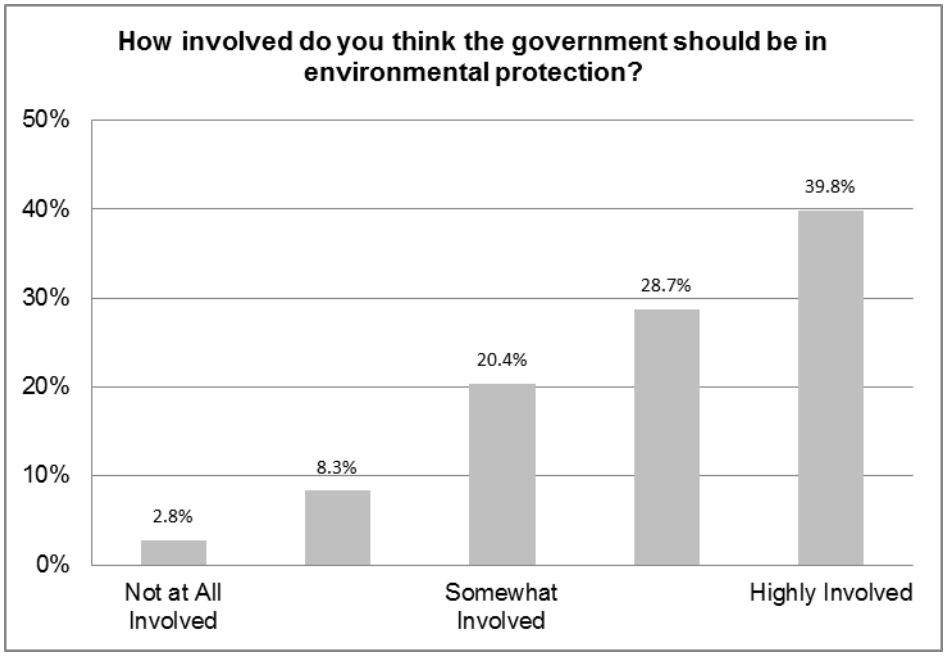


Figure 7-2 – Summary of Northeast Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Northeast Region

Table 7-4—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Northeast Region [a,b]

Variable	*T*-test	Mann-Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Importance of Aquatic Ecosystems	-	0.6598	0.9423
Age	0.4547	-	-
Gender	-	**0.0003**	**0.0003**
Education [c]	-	**0.3269**	**0.0147**
Employment	-	0.8682	0.8677
Hispanic/Latino	-	0.8343	0.8334
Race	-	0.8051	0.8045
Income	-	0.2336	0.2329

[a] The null hypothesis for all three tests is equality of means across respondents and non-respondents.
[b] Shading indicates that the variable values are statistically different across respondents and non-respondents.
[c] The results reported for the χ^2 test of proportions for education are based on Fisher's exact test because 21% of the education cells had expected counts less than 5.

7.2.2 Southeast Region (AL, FL, GA, LA, MS, NC, SC, TX, and VA)

Table 7-5 provides demographic characteristics for participants in the Southeast main mail survey and non-response survey. Figure 7-3 summarizes respondent and non-respondent attitudes toward the importance of protecting aquatic ecosystems. A large majority of respondents to both the main mail survey (87.4%) and non-response study (91.9%) indicated that they consider the protection of aquatic ecosystems to be at least somewhat important. Figure 7-4 summarizes non-respondents' preferences for government involvement in environmental protection. The vast majority of non-respondents (82.8%) think that the government should be at least somewhat involved in environmental protection, and 41.1% think that it should be highly involved. The statistical testing results in Table 7-6 show that variable values for gender and education are statistically different across respondents and non-respondents at $p<0.10$. EPA does not reject the null hypothesis of equality for the remaining demographic variables in the Southeast survey region. "Importance of aquatic ecosystems" is not statistically different across the respondent and non-respondent samples.

Table 7-5—Demographic Characteristics of the Main and Non-Response Samples for the Southeast Survey Region

Statistic	Value/Percentage of Sample [a]	
	Main Mail Sample	Non-Response Sample
Average age of respondents	54.3	56.6
Percent under 65 [b]	74.1%	68.9%
Percent male respondents [c]	62.3%	46.7%
Percent currently employed	59.2%	57.9%
Percent employed under age 65	75.0%	79.4%
Highest Level of Education		
Less than High School	4.4%	5.3%
High School or Equivalent	16.0%	25.3%
High School +Technical School	11.4%	15.3%
One or More Years of College	24.1%	20.0%
Bachelor's Degree	25.8%	14.7%
Graduate Degree	18.3%	19.3%
Hispanic or Latino Origin	9.9%	9.9%
Racial Category [d]		
American Indian or Alaskan Native	3.9%	0.7%
Black or African American	14.7%	17.8%
Native Hawaiian or Other Pacific Islander	0.0%	0.0%
Asian	2.6%	2.7%
White	82.3%	78.8%
Average Household Size	2.5	2.5
Number of household members 16 or older	1.9	1.9
Total Household Income [e]		
Average	$75,588	$74,179
Standard Deviation	$62,618	$66,760
Consume commercially caught fish or seafood	89.3%	88.1%
Consume recreationally caught fish or seafood	59.5%	52.7%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to about 83.0% for 18+ population in Southeast states based on Census 2010.
[c] The population is 48.4% male averaging across the 18+ population in Southeast states, based on Census 2010.
[d] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

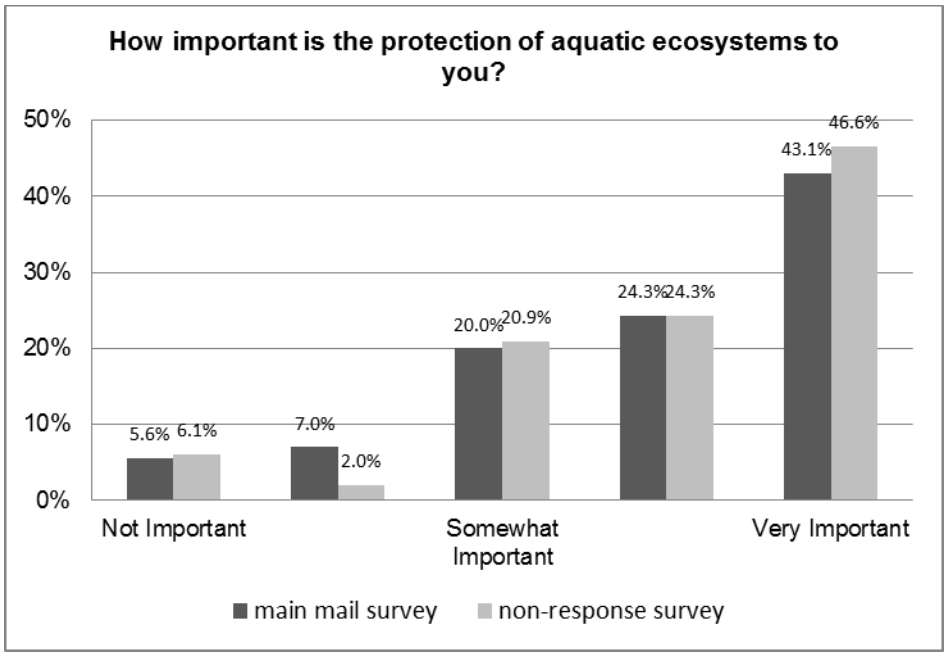


Figure 7-3 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Southeast Region

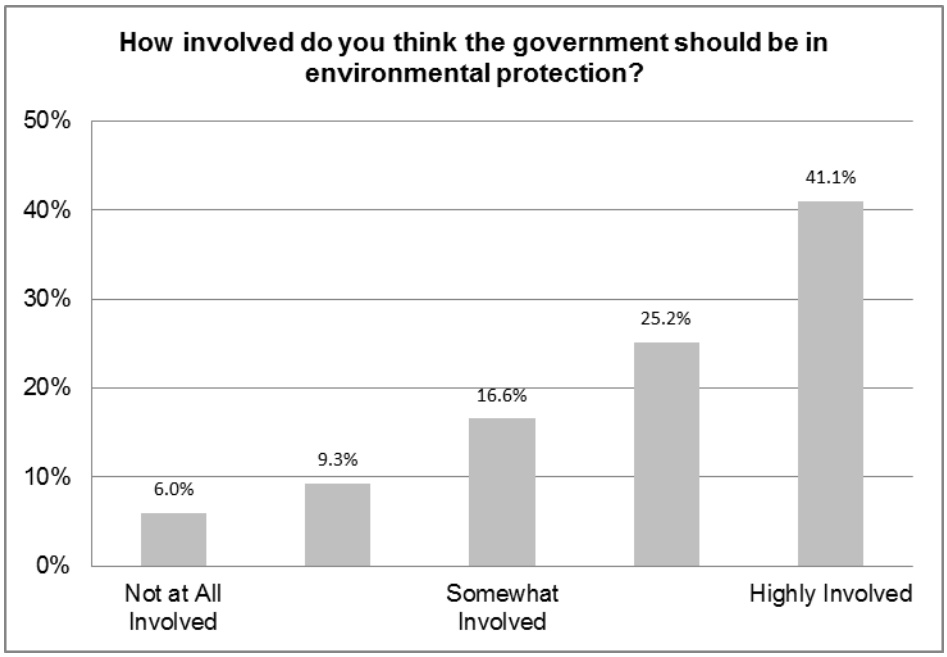


Figure 7-4 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Southeast Region

Table 7-6—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Southeast Region [a,b]

Variable	*T*-test	Mann-Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Importance of Aquatic Ecosystems	-	0.3214	0.2634
Age	0.1068	-	-
Gender	-	**<0.0001**	**<0.0001**
Education	-	**0.0244**	**0.0084**
Employment	-	0.7816	0.7812
Hispanic/Latino	-	0.9892	0.9888
Race	-	0.8622	0.8618
Income	-	0.4973	0.4967

[a] The null hypothesis for all three tests is equality of means across respondents and non-respondents.
[b] Shading indicates that the variable values are statistically different across respondents and non-respondents.

7.2.3 Pacific Region (CA, OR, and WA)

Table 7-7 provides demographic characteristics for participants in the Pacific main mail survey and non-response survey. Figure 7-5 summarizes respondent and non-respondent attitudes toward the importance of protecting aquatic ecosystems. A large majority of respondents to both the main mail survey (88.2%) and non-response study (96.1%) indicated that they consider the protection of aquatic ecosystems to be at least somewhat important. Figure 7-6 summarizes non-respondents' preferences for government involvement in environmental protection. The vast majority of non-respondents (93.4%) think that the government should be at least somewhat involved in environmental protection, and 46.1% think that it should be highly involved.

The statistical testing results in Table 7-8 show that race is the only demographic variable that is statistically different across respondents and non-respondents at $p<0.10$. EPA does not reject the null hypothesis of equality for the remaining tested demographic variables in the Pacific survey region. "Importance of aquatic ecosystems" is statistically different at about $p=0.02$ using the χ^2 Test of Proportions, but is not statistically different using the Mann-Whitney U Test ($p=0.76$). As shown in Figure 7-5, non-respondents placed a slightly greater importance on protecting aquatic ecosystems, with an average score of 4.1 compared to 4.0 for respondents where a score of 1.0 equals "not important" and 5 equals "very important." Weighting based on "importance of aquatic ecosystems" is problematic because the Pacific non-response sample (78 total completed non-response surveys) is the only available point of adjustment, and this variable is likely to be endogenous. EPA decided not to weight for "importance of aquatic ecosystems" in the Pacific survey region based on the mixed results of the statistical tests and endogenous nature of this variable.

Table 7-7—Demographic Characteristics of the Main and Non-Response Samples for the Pacific Survey Region

Statistic	Value/Percentage of Sample [a]	
	Main Mail Sample	Non-Response Sample
Average age of respondents	52.8	49.7
Percent under 65 [b]	76.1%	89.6%
Percent male respondents [c]	62.7%	55.1%
Percent currently employed	65.0%	68.4%
Percent employed under age 65	80.3%	74.6%
Highest Level of Education		
Less than High School	1.7%	3.9%
High School or Equivalent	13.6%	14.3%
High School +Technical School	7.5%	10.4%
One or More Years of College	26.4%	27.3%
Bachelor's Degree	28.8%	28.6%
Graduate Degree	22.0%	15.6%
Hispanic or Latino Origin	13.3%	13.3%
Racial Category [d]		
American Indian or Alaskan Native	3.6%	4.3%
Black or African American	3.6%	5.7%
Native Hawaiian or Other Pacific Islander	0.4%	2.9%
Asian	10.9%	18.6%
White	84.7%	75.7%
Average Household Size	2.6	3.0
Number of household members 16 or older	1.9	3.5
Total Household Income [e]		
Average	$96,144	$79,306
Standard Deviation	$71,282	$67,757
Consume commercially caught fish or seafood	90.4%	80.0%
Consume recreationally caught fish or seafood	50.5%	38.7%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to about 84.5% for 18+ population in Pacific states based on Census 2010.
[c] The population is 49.2% male averaging across the 18+ population in Pacific states, based on Census 2010.
[d] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

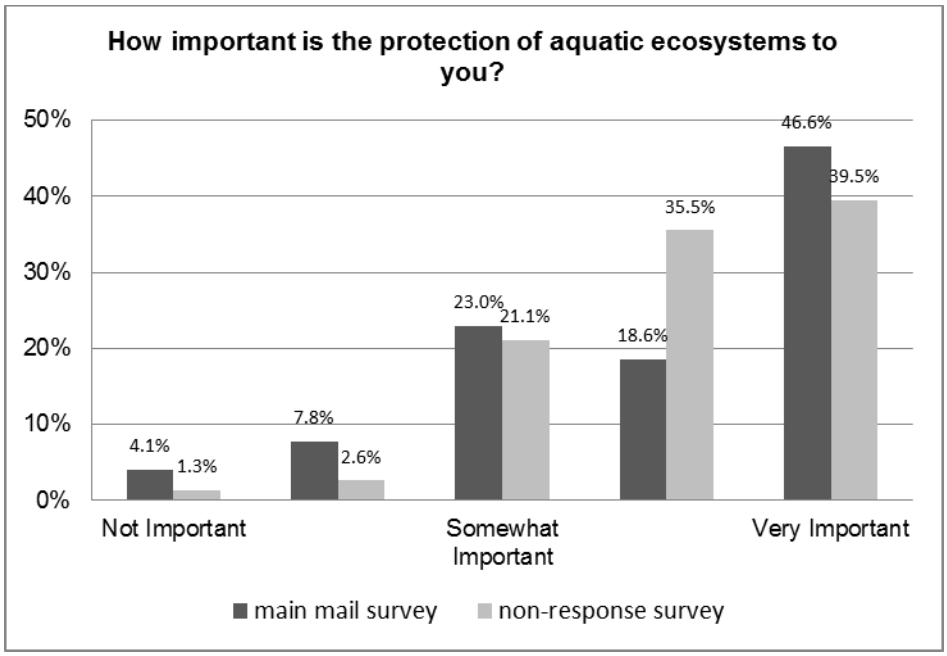


Figure 7-5 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Pacific Region

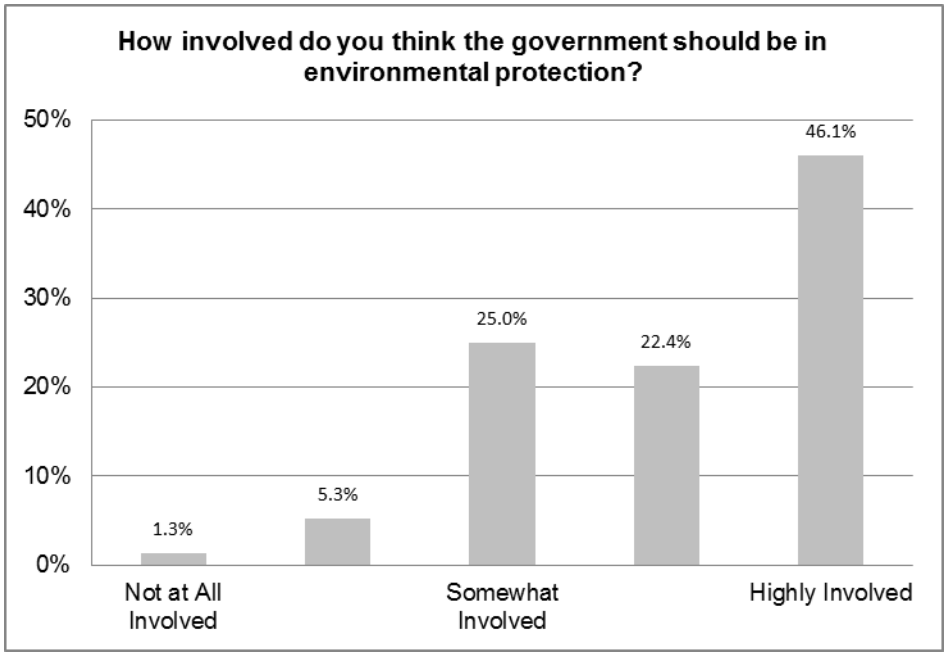


Figure 7-6 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Pacific Region

Table 7-8—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Pacific Region [a,b]

Variable	*T*-test	Mann-Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Importance of Aquatic Ecosystems	-	**0.7584**	**0.0150**
Age	0.1165		
Gender	-	0.2226	0.2217
Education	-	0.1683	0.6547
Employment	-	0.5728	0.5717
Hispanic/Latino	-	0.9885	0.9876
Race	-	**0.0239**	**0.0237**
Income	-	0.2757	0.2746

[a] The null hypothesis for all three tests is equality of means across respondents and non-respondents.
[b] Shading indicates that the variable values are statistically different across respondents and non-respondents.

7.2.4 Inland Region (AR, AZ, CO, ID, IA, IL, IN, KS, KY, MI, MN, MO, MT, ND, NE, NM, NV, OH, OK, SD, TN, UT, WI, WV, and WY)

Table 7-9 provides demographic characteristics for participants in the Inland main mail survey and non-response survey. Figure 7-7 summarizes respondent and non-respondent attitudes toward the importance of protecting aquatic ecosystems. A large majority of respondents to both the main mail survey (85.6%) and non-response study (89.8%) indicated that they consider the protection of aquatic ecosystems to be important. Figure 7-8 summarizes non-respondents' preferences for government involvement in environmental protection. The vast majority of non-respondents (88.3%) think that the government should be at least somewhat involved in environmental protection, and 38.1% think that it should be highly involved. Testing results in Table 7-10 show that five variables are statistically different across respondents and non-respondents at $p<0.10$: (1) age, (2) gender, (3) education, (4) employment, and (5) income. EPA does not reject the null hypothesis of equality for the remaining three tested variables for the Inland survey region. The statistical difference for employment is largely attributable to the difference in age across the two samples. Employment is not statistically different for respondents under the age of 65. Based on this finding, EPA did not include employment when estimating weights for the Inland region. "Importance of aquatic ecosystems" is not statistically different across respondent and non-respondent samples.

Table 7-9—Demographic Characteristics of the Main and Non-Response Samples for the Inland Survey Region

Statistic	Value/Percentage of Sample [a]	
	Main Mail Sample	Non-Response Sample
Average age of respondents	53.7	56.1
Percent under 65 [b]	76.3%	67.4%
Percent male respondents [c]	64.6%	51.3%
Percent currently employed	64.4%	54.4%
Percent employed under age 65	76.9%	73.8%
Highest Level of Education		
Less than High School	1.8%	9.2%
High School or Equivalent	16.8%	28.1%
High School +Technical School	13.8%	13.3%
One or More Years of College	24.5%	19.4%
Bachelor's Degree	22.4%	19.9%
Graduate Degree	20.7%	10.2%
Hispanic or Latino Origin	3.4%	5.2%
Racial Category [d]		
American Indian or Alaskan Native	3.2%	3.8%
Black or African American	6.6%	5.9%
Native Hawaiian or Other Pacific Islander	0.5%	0.5%
Asian	2.8%	1.1%
White	91.0%	93.0%
Average Household Size	2.5	2.9
Number of household members 16 or older	1.9	2.4
Total Household Income [e]		
Average	$73,567	$59,598
Standard Deviation	$57,261	$54,966
Consume commercially caught fish or seafood	89.7%	74.7%
Consume recreationally caught fish or seafood	61.0%	43.7%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to about 82.4% for 18+ population in Inland states based on Census 2010.
[c] The population is 48.8% male averaging across 18+ population in Inland states, based on Census 2010.
[d] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

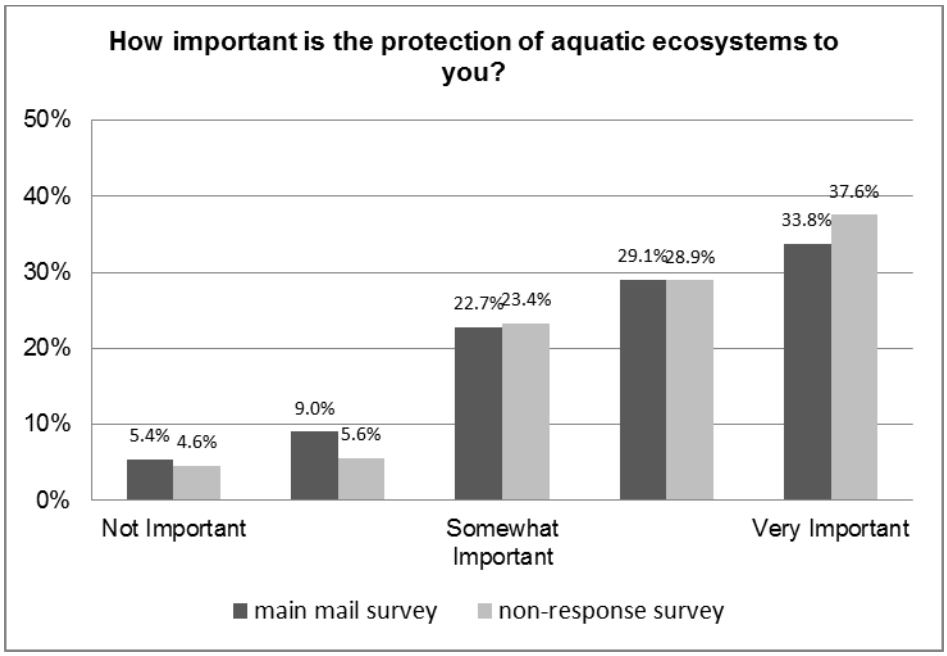


Figure 7-7 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the Inland Region

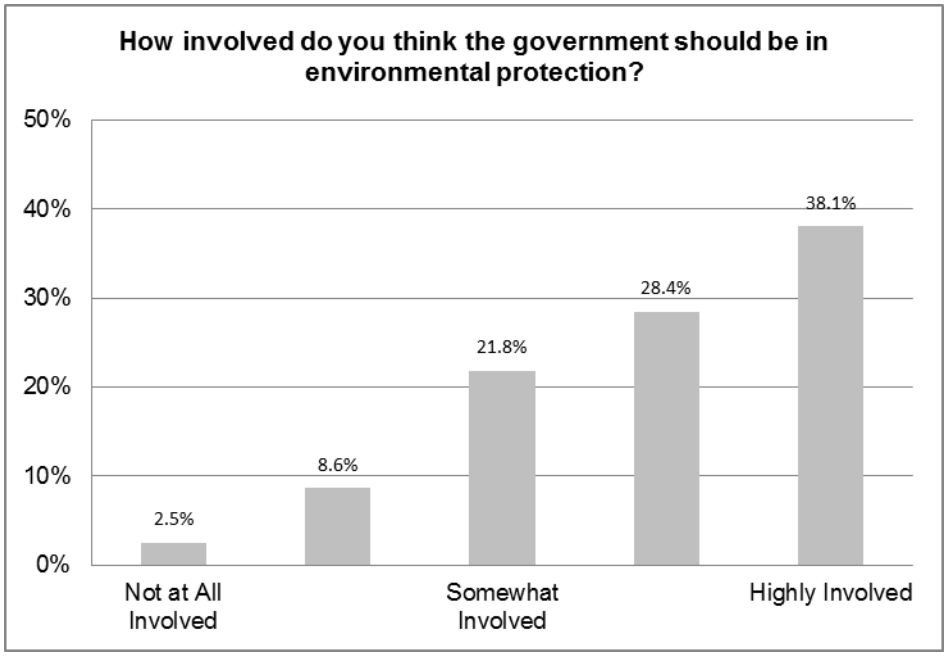


Figure 7-8 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the Inland Region

Table 7-10—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Inland Region [a,b]

Variable	*T*-test	Mann-Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Importance of Aquatic Ecosystems	-	0.2556	0.5517
Age	**0.0573**	-	-
Gender	-	**0.0006**	**0.0006**
Education	-	**<.0001**	**<.0001**
Employment [c]	-	**0.0102**	**0.0102**
Hispanic/Latino	-	0.2539	0.2535
Race	-	0.6635	0.6632
Income	-	**<.0001**	**<.0001**

[a] The null hypothesis for all three tests is equality of means across respondents and non-respondents.
[b] Shading indicates that the variable values are statistically different across respondents and non-respondents.
[c] Employment is not statistically different for respondents under the age of 65.

7.2.5 National Survey Version (All States except AK and HI)

Table 7-11 provides demographic characteristics for participants in the national main mail survey and non-response survey. Figure 7-9 summarizes respondent and non-respondent attitudes toward the importance of protecting aquatic ecosystems. A large majority of respondents to both the main mail survey (88.4%) and non-response study (88.8%) indicated that they consider the protection of aquatic ecosystems to be important. As shown in Figure 7-10, 94.9% of participants in the non-response survey think that the government should be at least somewhat involved in environmental protection, and 45.6% think that it should be highly involved. The statistical testing results in Table 7-12 show that variable values for gender and income are statistically different across respondents and non-respondents at $p<0.10$. EPA does not reject the null hypothesis of equality for the remaining tested variables for the national survey. "Importance of aquatic ecosystems" is not statistically different across respondent and non-respondent samples.

Table 7-11—Demographic Characteristics of the Main and Non-Response Samples for the National Survey Region

Statistic	Value/Percentage of Sample [a]	
	Main Mail Sample	Non-Response Sample
Average age of respondents	53.7	53.2
Percent under 65	76.3%	70.0%
Percent male respondents [c]	64.6%	45.6%
Percent currently employed	64.4%	57.0%
Percent employed under age 65	76.9%	72.7%
Highest Level of Education		
Less than High School	1.8%	6.3%
High School or Equivalent	16.8%	16.5%
High School +Technical School	13.8%	10.1%
One or More Years of College	24.5%	27.8%
Bachelor's Degree	22.4%	20.3%
Graduate Degree	20.7%	19.0%
Hispanic or Latino Origin	3.4%	11.4%
Racial Category [d]		
American Indian or Alaskan Native	3.2%	2.7%
Black or African American	6.6%	11.0%
Native Hawaiian or Other Pacific Islander	0.5%	0.0%
Asian	2.8%	6.8%
White	91.0%	80.8%
Average Household Size	2.5	2.3
Number of household members 16 or older	1.9	1.8
Total Household Income [e]		
Average	$73,567	$63,681
Standard Deviation	$57,261	$57,415
Consume commercially caught fish or seafood	89.7%	78.8%
Consume recreationally caught fish or seafood	61.0%	42.3%

[a] Respondents who did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to about 82.8% for 18+ population nationally based on Census 2010.
[c] The population is 48.5% male for at the 18+ population nationally, based on Census 2010.
[d] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. The amount of $250,000 was used for the highest income category included in the survey ("$250,000 or more").

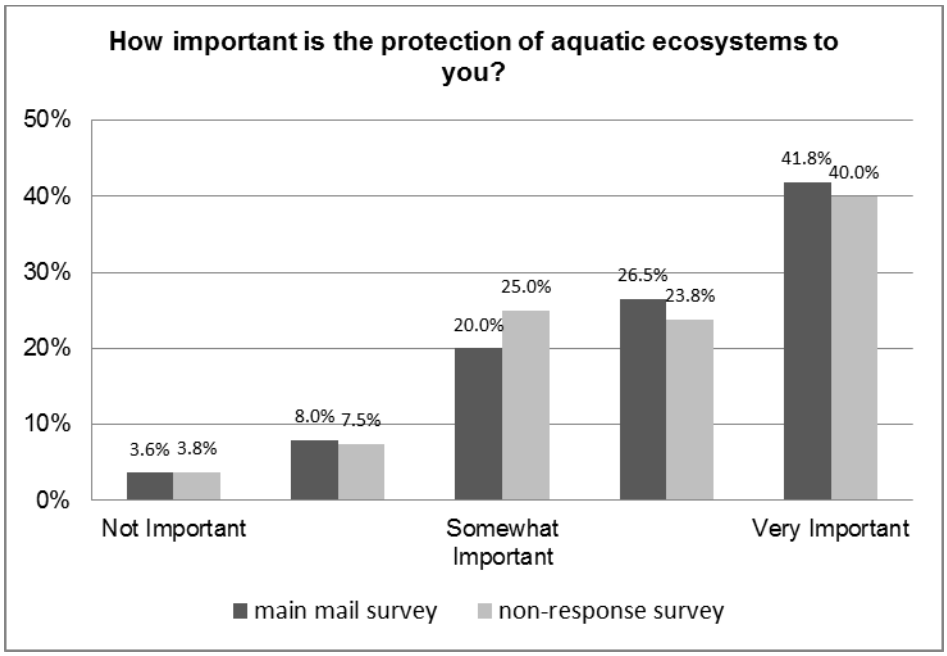


Figure 7-9 – Summary of Respondent and Non-Respondent Attitudes on the Importance of Aquatic Ecosystems for the National Survey

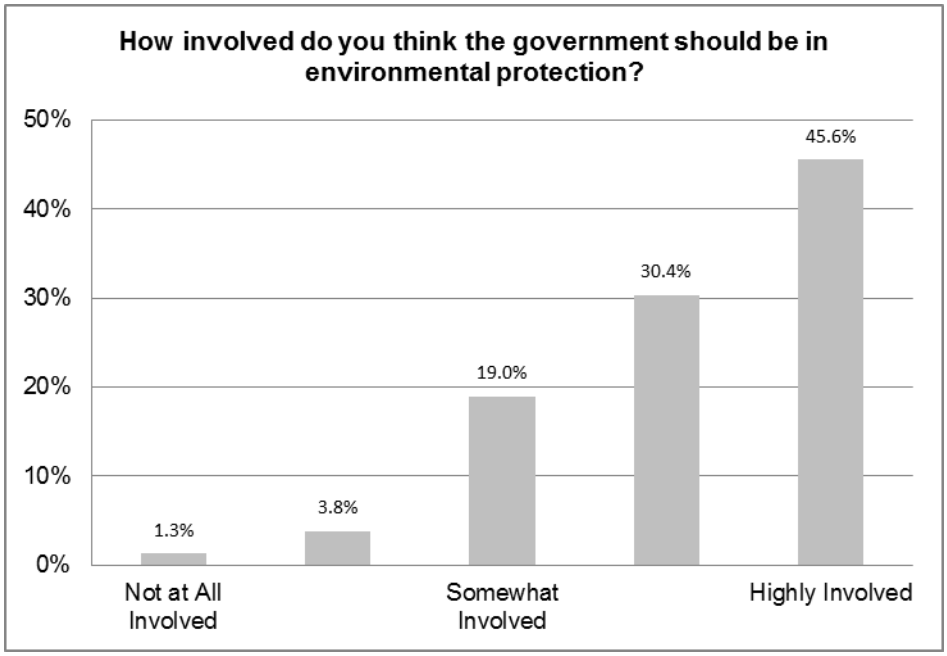


Figure 7-10 – Summary of Non-Respondent Attitudes on Government Involvement in Environmental Protection for the National Survey

Table 7-12—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the National Survey Version [a,b]

Variable	*T*-test	Mann-Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Importance of Aquatic Ecosystems	-	0.6370	0.9111
Age	0.6627	-	-
Gender	-	**0.0187**	**0.0185**
Education	-	0.5788	0.5642
Employment	-	0.6044	0.6034
Hispanic/Latino	-	0.2042	0.2031
Race	-	0.6923	0.6912
Income	-	**0.0305**	**0.0302**

[a] The null hypothesis for all three tests is equality of means across respondents and non-respondents.
[b] Shading indicates that the variable values are statistically different across respondents and non-respondents.

8 The Random Utility Model

8.1 Model Specification

EPA's analysis of the 316(b) SP survey data is grounded in the random utility model of Hanemann (1984) and McConnell (1990). The use of the random utility model is standard in the SP literature for attribute-based experiments such as choice experiments, and allows well-defined welfare measures (i.e., WTP) to be derived from choice experiment models (Bennett and Blamey 2001; Bateman et al. 2002). From a purely mechanistic perspective, survey results are used to derive total values following standard practice for choice experiments (Adamowicz et al. 1998). Under the random utility model, "utility is the sum of systematic [or observed] and random [or unobserved] components" (Holmes and Adamowicz 2003, p. 189). The individual choices are treated as systematic (i.e., deterministic), while the random component reflects researcher uncertainty about the choice (i.e., to capture all factors that influence the choices that are observed or known by the respondents but unobserved by the researcher) (Holmes and Adamowicz 2003).

Applying this standard model to choices among policy options to reduce I&E mortality losses, EPA defines a utility function $U_i(\cdot)$ that includes environmental attributes of the policy option and the net cost of the plan to the respondent. Following standard random utility theory, utility is assumed to be known to the respondent, but stochastic from the perspective of the researcher, such that:

(Eq. 1) $$U_i(\cdot) = U(\mathbf{X_i}, \mathbf{D}, Y\text{-}F_i) = v(\mathbf{X_i}, \mathbf{D}, Y\text{-}F_i) + \varepsilon_i$$

where:

$\mathbf{X_i}$ = A vector of variables describing attributes of I&E reduction plan i

$\mathbf{D}$ = A vector characterizing demographic and other attributes of the respondent[19]

[19] Demographic interactions for gender and education were included in a preliminary model estimated for the Northeast region, the results of which are presented in Appendix G. EPA did not include demographic variables in other models.

Y = Disposable income of the respondent

F_i = Mandatory additional cost faced by the household under plan i

$v(\cdot)$ = A function representing the empirically estimable component of utility

ε_i = Stochastic or unobservable component of utility, modeled as an econometric error.

Econometrically, a model of such a preference function is obtained by methods designed for limited dependent variables, because researchers only observe the respondent's choice among alternative policy options, rather than observing values of $U_i(\cdot)$ directly (Maddala 1983; Hanemann 1984). Standard random utility models are based on the probability that a respondent's utility from Option i, $U_i(\cdot)$, exceeds the utility from alternative Option j, $U_j(\cdot)$, for all potential Options $j \neq i$ considered by the respondent. In this case, the respondent's choice set of potential policies also includes maintaining the status quo, where the status quo (or "Neither Plan") is characterized by zero change in all policy attributes. The random utility model presumes that the respondent assesses the utility that would result from each Option i (including the status quo), and chooses the policy option that would offer the highest utility. When faced with k distinct policy options defined by their attributes, the respondent will choose Option i if the anticipated utility from Option i exceeds that of all other k-1 plans. Drawing from Eq. 1, the respondent will choose plan i if:

(Eq. 2) $$(v(\mathbf{X}_i, \mathbf{D}, Y\text{-}F_i) + \varepsilon_i) \geq (v(\mathbf{X}_k, \mathbf{D}, Y\text{-}F_k) + \varepsilon_k) \; \forall \; k \neq i.$$

Table 8-1 lists and defines the variables included in the random utility models for the regional and national surveys. For each choice option, the respondent may choose Option A, Option B, or Neither, where "neither" is characterized by zero change in all attributes. The treatment of demographic characteristics within the random utility model varies in the stated preference literature. Some studies do not include demographic variables within estimated models (e.g., Johnston et al. 2012; Campbell et al. 2009) while some others have included demographic variables (e.g., Carlsson et al. 2003; Do and Bennett 2009). EPA notes it included demographic interactions between ecological attributes andgender and education in a preliminary Northeast model (see Appendix G for detail). Because the interaction terms did not improve the model fit, EPA did not include demographic variables in other models. The survey used a random sample of households within each region (see Section 8.3) and thus the estimated WTP values are representative of average WTP in a given region.

Table 8-1—Summary of Variables Included in the Random Utility Models for the Regional and National Surveys

Variable [a]	Variable Definition
CONSTANT	Alternative specific constant (ASC) associated with the status quo, or choice of neither plan.
COM_FISH	Score showing the overall health of commercial and recreational fish populations.
FISH_POP	Score showing the estimated size of all fish populations compared to natural levels without human influence.
FISH_SAV	Score showing the reduction in young fish lost compared to current levels.
AQUATIC	Score showing the ecological condition of affected areas, compared to the most natural waters in the region (e.g., Northeast).
COST	The increase in annual household cost, in unavoidable price increases for products and services, including electricity and common household products.
[redacted]	

The linear econometric specification of the model appears as:

(Eq. 3) $$v(\cdot) = \beta_0 + \beta_1(fish\_sav) + \beta_2(\Delta com\_fish) + \beta_3(\Delta fish\_pop) + \beta_4(\Delta aquatic) + \beta_5(cost)$$

This specification allows EPA to estimate the relative "main effects" of the four environmental attributes on utility. The estimated constant (β_0) represents the ASC associated with the status quo. The ASC (*constant*) is a fixed coefficient estimated within choice experiments that is designed to capture "systematic but unobserved information about why respondents chose a particular option (that is, unrelated to choice set attributes)" (Bennett et al. 2001). ASCs become statistically significant in choice experiment models when elements other than the independent variables, or choice attributes, in the model influence respondents' choices (Kerr and Sharp 2006).

[redacted]

8.2 Model Estimation

EPA estimated the random utility models for all four regions and the national survey using maximum likelihood mixed logit. The mixed logit model is an approach for modeling preference heterogeneity based on the assumption that individual's preferences are randomly distributed and that heterogeneity in population preferences can be captured by estimating the mean and variance of the random parameter distributions (Holmes and Adamowicz 2003). As described by Hensher and Greene (2003, p. 170), "the mixed logit model offers an extended framework within which to capture a greater amount of behavioral choice making. Broadly speaking the mixed logit model aligns itself much more with reality than most discrete choice models with every individual having their own inter-related systematic and random components for each alternative in their perceptual choice set(s)." It is a highly flexible model that "obviates the three limitations of standard logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time" (Train 2009, p.134). The mixed logit model allows for the possibility of preference heterogeneity but cannot attach specific parameter values to particular individuals. That is, the mixed logit model relaxes the assumption of respondents

being identical (required for multinomial logit estimation), replacing it with a less restrictive assumption that respondents are identically distributed. The theory and methods of mixed logit modeling are well-established (Train 2009), and mixed logit modeling has now become standard practice in many areas of research (Hensher and Greene 2003). These models allow for coefficients on attributes to be distributed across sampled individuals according to a set of estimated coefficients and researcher-imposed restrictions. The model is evaluated numerically using random draws because choice probabilities take the form of an integral over a mixing distribution that does not have a closed form (Train 2009). The likelihood simulation for the models estimated by EPA used 300 Halton (random) draws.

With the additional flexibility of the mixed logit model comes additional choices related to model specification and estimation. Economic theory provides guidance regarding some, but not all, aspects of model specification for mixed logit models within SP choice experiments. For example, the parameter on program cost is expected to have a negative sign, reflecting a positive marginal utility of income. To allow for this, models included specifications in which the coefficient on cost was modeled as (1) fixed, (2) lognormal, and (3) bounded triangular. [redacted] These are among the most common specifications that impose the desired sign on the cost coefficient (Hensher and Greene 2003; Johnston and Bergstrom 2011). A normal distribution is generally considered inappropriate for the coefficient on program cost, as the shape of this distribution typically imposes a negative marginal utility of income on a portion of the sample (a small portion of the distribution will lie in the negative domain).

Coefficients on all variables except that on program cost (*cost*) are specified as random with a normal distribution. This also reflects common practice in mixed logit models of this type. The majority of estimated models allow free correlation among random coefficients (i.e., Cholesky off-diagonals are permitted to be non-zero); additional discussion is provided below. The model also accounts for correlation across multiple questions answered by each respondent because the same set of preference parameters is assumed to govern all choices by each individual respondent (panel data).

8.3 Approach for Estimating Model Weights

EPA developed model weights for each region to account for the over- and under-representation of demographic groups in the mail survey data for each region. EPA determined which demographic groups required weights by statistically comparing respondent and non-respondent populations. Refer back to Section 7.2 for the results of these statistical tests. For the Northeast region, gender and education were statistically different across respondent and non-respondent populations. EPA estimated a preliminary linear model with interactions for gender and education to assess the need for weighting. Some of the interactions variables were found to be individually statistically significant. However, the fact that the model χ^2 for the interactions model is lower than for a comparable model without interactions implies local rather than global convergence for the mixed logit interactions model. Based on these results, EPA decided to estimate weighted models to account for the potential influence of demographic characteristics and demographic representativeness of the mail survey sample on estimated WTP. Full results for the preliminary model with interactions are presented in Appendix G.

EPA used one of two approaches, referred to here as "subgroup weighting" and "raking," to calculate the weights assigned to each respondent in the mail survey dataset. The approach to weighting used for each region was determined based on the combination of demographic characteristics that were statistically different between respondents and non-respondents within the region. The subgroup weighting approach was used for the Northeast, Southeast, and Pacific regions because the proportion assigned to each subgroup could be calculated directly based on data from the American Community Survey (ACS) or Census. Raking was used for the Inland region and national version because the subgroup targets for the

variables of interest could not be calculated directly from ACS or Census. Additional description of the subgroup weighting and raking procedures is provided in the following two subsections.

8.3.1 Subgroup Weighting

Subgroup weighting to reduce non-response biases adjusts the weight given to individual observations in a statistical analysis. This adjustment is implemented so that the weight given to a particular subgroup of individuals within the analyzed sample matches the weight for the same subgroup in the desired population (Yansaneh 2003). This weighting approach was used for gender and education in the Northeast and Southeast regions and race in the Pacific region because the proportion assigned to each subgroup could be calculated directly based on data from ACS and Census 2010. For example, the 2010 ACS reports educational attainment by gender, so weights for the specific "subgroups" listed in Table 8-2 could be calculated directly from the data. The non-response adjustment weight (w_i) for the i^{th} subgroup is given by:

(Eq. 5) $w_i =$.

where:

R_i = the known representation (or proportion) of subgroup i in the target population

S_i = is the representation (or proportion) of subgroup i in the main mail survey sample.

Subgroups are defined as individuals characterized by a particular combination of demographic or other attributes. The number of subgroups is generally equal to , where D_r is the number of possible outcomes (levels) for the r^{th} attribute. For example, non-response weighting according to gender (male vs. female) and education (no bachelor's degree vs. bachelor's degree or higher), has four subgroups (male without a bachelor's degree, male with a bachelor's degree, female without a bachelor's degree, and female with a bachelor's degree).

The resulting subgroups and proportions are presented in Table 8-2 and Table 8-3. Under this approach, respondents are excluded from model estimation if they fail to provide answers for all variables being used in weighting. EPA did not impute values in these cases.

Table 8-2—Subgroups Included within the Northeast and Southeast Weighted Models [a,b]

Subgroup	Definition	Northeast Region		Southeast Region	
		Sample Proportion (S_i)	Population Proportion (R_i)	Sample Proportion (S_i)	Population Proportion (R_i)
M1	Male, age 18+, without a bachelor's degree	0.34	0.33	0.33	0.37
M2	Male, age 18+, with bachelor's degree or higher	0.30	0.14	0.30	0.11
F1	Female, age 18+, without a bachelor's degree	0.20	0.37	0.23	0.40
F2	Female, age 18+, with bachelor's degree or higher	0.16	0.16	0.14	0.12

[a] EPA calculated the sample proportion for each subgroup based on respondents who provided both educational attainment and gender information.
[b] EPA calculated the population proportion for each subgroup based on 5-year estimates of educational attainment of the age 18+ population within regional states from the 2010 ACS. After the 2000 Census, the U.S. Census Bureau no longer asked questions about educational attainment and income as part of its Decennial Census series; instead, it developed the ACS to track these variables annually.

Table 8-3—Subgroups Included within the Pacific Weighted Model

Subgroup	Definition	Sample Proportion (S_i) [a]	Population Proportion (R_i) [b]
R1	age 18+, white racial category	0.82	0.65
R2	age 18+, other racial categories	0.18	0.35

[a] EPA calculated the sample proportion for the two subgroups based on respondents who answered the survey question that asked for the respondent's race.
[b] EPA calculated the population proportion for the two subgroups based on race for the age 18+ population in Pacific states from Census 2010.

8.3.2 Raking Procedure

A raking procedure was used to assign weights for the Inland region and national survey. In these cases, the number and combination of variables are such that the grid of sample and population proportions cannot be calculated directly using Census data. In contrast with the subgroup weighting approach, none of the surveys conducted by the U.S. Census Bureau have data broken out by all variables listed in Table 8-4. The first step was to compute a set of socio-demographic population benchmarks for each variable of concern using data from the Census, filtering on the population living within the survey region. The weights were created in SAS using a raking macro that aligned the marginal distribution of respondents on demographic characteristics of interest to look at the marginal distribution of those characteristics in the population. In the first iteration, the program matches the distribution of the first demographic variable to the population benchmark, recalculates the cell counts, and creates new totals. The second iteration matches the distribution of the second demographic variable to its population benchmark using the new cell counts from the first iteration and calculates new totals. The algorithm continues these

iterations, alternating between the distributions of demographic variables until the adjusted weighted totals converge with the population benchmark totals, and a final set of raked weights are produced.

Some respondents failed to answer all demographic questions. EPA imputed data from a randomly selected similar record (i.e., "hot-deck imputation") in order to fill the missing observations for weighted variable. It is important to note that imputed values were only used for the purposes of computing the weights.

Table 8-4—Weighting Targets Used for the Inland and National Survey Versions [a]

Variable	Inland Survey [b]	National Survey
Gender (percentage of the population that is male)	0.488	0.485
Age (18-34, 35-65, and 65+)	0.302, 0.522, 0.176	-
Education (percentage of population with bachelor's degree or higher)	0.235	-
Income (percentage of households with incomes less than $60,000)	0.595	0.565

[a] Targets for gender were based on Census 2010. Targets for age, education, and income were based on the 2010 ACS. Benefiting from a large sample size (approximately 3 million U.S. households annually), the ACS provides communities with a reliable source of demographic, housing, social, and economic data not reported in the Decennial Census. While other datasets such as the Current Population Survey also report educational attainment and household income, the sample size is smaller – around 78,000 households annually.
[b] EPA included a yes/no question asking survey respondents whether they are currently employed. This question does not account for whether the "unemployed" are retired or are currently looking for work. Under this question format, correlation between age and unemployment is highly likely, because retirees are categorized as unemployed. As shown in Table 7-10, both age and employment were found to be statistically different across Inland respondent and non-respondent samples. However, further analysis revealed that employment is not statistically different for respondents under the age of 65. Based on this finding, EPA did not include employment in the raking procedure for the Inland region.
[c] The Inland raking procedure also included a target for race based on Census 2010 for states in the Inland region. EPA does not believe that its inclusion adversely affects the Inland model weights.

After the raked weight was generated, EPA examined the distribution of values. Extreme weight values tend to unduly increase the variance in the weights and reduce the precision of survey estimates. The tradeoff is that weights serve to reduce bias, and trimming too severely can undermine the power of the weights to reduce bias. EPA examined the distribution of the largest weights for extreme values and identified a threshold that was the lower bound of a large gap in the distribution preceding the largest weight value. For the Inland region, the largest weight value was then trimmed to equal this threshold (6.626). The weights were then summed to equal the unweighted sample size of 787 Inland survey respondents. For the national version, EPA examined the distribution of the weights and determined that trimming was not necessary. The weights were summed to equal the unweighted sample size of 288 national survey respondents.

8.4 Model Results

Comparison of preliminary models suggests that (1) the most stable (robust) welfare estimates are achieved when the cost parameter is modeled as fixed, and (2) specifying a random coefficient on cost (e.g., with a bounded triangular or lognormal distribution) does not always lead to statistically significant improvements in model fit. Welfare (WTP) estimates are often sensitive to observations in the tails of estimated distributions when cost parameters are random; hence, greater robustness is typically achieved

with fixed cost coefficients. This sensitivity is particularly acute when the cost parameter is modeled with a lognormal distribution (cf. Hensher and Greene 2003; Johnston and Bergstrom 2011). Random specifications of the cost parameter that typically result in more stable welfare estimates, such as the bounded triangular distribution, did not result in statistically significant improvements in model fit when tested in the weighted Northeast model.[20] Given these results, EPA chose to rely on the model with a fixed cost coefficient. [redacted]

To verify the stability of model results and welfare estimates within this model (given potential difficulties with local rather than global convergence in at least one model estimation), EPA evaluated the stability of regional and national model results under a variety of different estimation and simulation specifications, including different starting seeds and numbers/types of random draws in the likelihood simulation (Hensher and Greene 2003).[21] These tests verify the stability of the presented results over different simulations.

In Table 8-5 through Table 8-9, EPA represents the results of three models estimated for each region and the national survey: (1) a linear model (unweighted), (2) a weighted linear model, and (3) [redacted]. As noted above, all of the mixed logit models are run as panel models, and allow for free correlation across all random parameters. [redacted]

[20] Differences in model fit between the two models are also caused by an inability to specify fully correlated random parameters when the cost parameter is specified with a bounded triangular distribution, due to constraints on the distribution required to ensure a parameter estimate in the positive domain (i.e., the parameter estimate is equal to the spread, cf. Hensher and Greene 2003).

[21] The starting seed is the first number in the sequence of random draws within the simulation. Changing the starting seed results in a different sequence of random numbers.

[22] [redacted]

Looking specifically at the weighted linear models, the model χ^2 values range from 404.74 (d.f. = 21, $p<0.0001$) for the national survey to 1018.72 (d.f. = 21, $p<0.0001$) for the Inland region. The coefficent on the number of fish saved (*fish_sav*) is significant at $p<0.01$ for all regions and the national survey. Commercial fish population (*com_fish*) is significant at $p<0.05$ for the Northeast, the Southeast, and the national survey. Aquatic ecosystem condition was significant at $p<0.10$ in four of the five weighted linear models, with the only exception being Inland. Fish population (*fish_pop*) was significant in the national survey but was not significant in the regional weighted linear models. Household cost (*cost*) was significant at $p<0.01$ in all models, indicating that respondents were evaluating the cost of policy options.

As noted above, all variables except cost represent percent progress toward the upper ecological reference condition (100%). Hence, these coefficients may be directly interpreted as the relative marginal utility derived from a one percentage point change in each ecological attribute. In the estimated Northeast, Southeast, and national weighted linear models, for example, marginal utility is greatest (per percentage point change) for increases in aquatic ecological condition (*aquatic*), with lower (but still statistically significant) impacts associated with changes in commercial fish populations (*fish_pop*) and the number of fish saved (*fish_sav*). The percentage differences across the options presented were much larger for the number of fish saved (*fish_sav*) than for the other variables. Following recommended practice in SP valuation, these variations correspond with realistic ecological and policy expectations for regulatory outcomes (Bateman et al. 2002).

Direct comparisons of statistical fit measures across different choice experiments in the literature can be misleading and should be viewed with extreme caution. Many measures of model fit are not directly comparable across different datasets or models. Nonetheless, the overall statistical fit of the models

[23] The percent fish saved that results in the maximum household WTP varies across regions. Using mean implicit prices, it is 76.7% for the Northeast region, 80.2% for the Southeast Region, 82.1% for the Inland region and 88.4% for the National survey. Decreases in household WTP for increases in fish saved are exhibited in the Pacific region using mean implicit prices.

appears broadly similar to choice experiments found in the published literature addressing environmental improvements both in the United States and worldwide. Johnston et al. (2011a,b), in a similar survey of ecological improvements, report a χ^2 of 533.62 (d.f. = 12, $p<0.0001$)[24] and a pseudo R^2 of 0.30. By way of comparison using a commonly reported measure of model fit (pseudo or McFadden R^2), Campbell et al. (2009) report a pseudo R^2 of 0.20; Carlsson et al. (2003) report pseudo R^2 values between 0.12 and 0.27; Do and Bennett (2009) report pseudo R^2 between 0.07 and 0.18; and Colombo and Hanley (2008) report values between 0.16 and 0.36. Other measures of fit are also similar—although again caution must be exercised when drawing conclusions from any such comparisons across models.

Table 8-5—Results for the Northeast Region

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model	**Weighted Linear Model**
Random parameters in utility functions		
CONSTANT	-0.14284 (0.26495)	-0.16227 (0.30752)
COM_FISH	0.25448*** (0.05395)	0.11840*** (0.04173)
FISH_POP	0.09181 (0.07052)	0.05243 (0.06997)
FISH_SAV	0.02794*** (0.00607)	0.01966*** (0.00408)
AQUATIC	0.24403*** (0.08794)	0.14777** (0.07361)
Non-random parameters in utility functions		
[redacted]		
COST	-0.02913*** (0.00433)	-0.01547*** (0.00328)
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.00694 (1.02871)	0.02635 (0.86554)
sdCOM_FISH-	0.11153 (0.15991)	0.17310* (0.10258)
sdFISH_POP-	0.15133 (0.30835)	0.16384 (0.16684)
sdFISH_SAV-	0.07605** (0.03763)	0.03562*** (0.00857)
sdAQUATIC-	0.36392 (0.30161)	0.14577 (0.20373)
Model significance		
Model χ^2	505.90 (d f. = 21, $p<0.0001$)	498.17 (d f. = 21, $p<0.0001$)
Pseudo R^2	0.21	0.21

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.
[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

[24] EPA notes that the degrees of freedom are different from models presented in Table 8-2 to Table 8-6.

Table 8-6—Results for the Southeast Region

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model	Weighted Linear Model
Random parameters in utility functions		
CONSTANT	0.15092 (0.30432)	-0.03878 (0.37406)
COM_FISH	0.19741*** (0.03917)	0.19522*** (0.05024)
FISH_POP	0.13359* (0.05963)	0.07266 (0.07894)
FISH_SAV	0.02174*** (0.00457)	0.02831*** (0.00569)
AQUATIC	0.24231*** (0.06490)	0.23048*** (0.07881)
Non-random parameters in utility functions		
[redacted]		
COST	-0.03478*** (0.00328)	-0.03488*** (0.00361)
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.01646 (0.80766)	0.03457 (0.86377)
sdCOM_FISH-	0.06664 (0.60221)	0.12466 (0.29087)
sdFISH_POP-	0.05620 (0.66241)	0.07113 (0.65422)
sdFISH_SAV-	0.05944* (0.03553)	0.06815 (0.04194)
sdAQUATIC-	0.07825 (0.57001)	0.10197 (0.63782)
Model significance		
Model χ^2	671.50 (d f. = 21, p<0.0001	658.85 (d f. = 21, p<0.0001)
Pseudo R^2	0.23	0.23

[redacted]

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

Table 8-7—Results for the Pacific Region

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model	Weighted Linear Model
Random parameters in utility functions		
CONSTANT	0.23011 (0.41901)	0.21243 (0.55090)
COM_FISH	0.09553 (0.07512)	0.07425 (0.10340)
FISH_POP	0.12401 (0.10541)	0.11697 (0.15032)
FISH_SAV	0.06116*** (0.00729)	0.08338*** (0.01291)
AQUATIC	0.22299** (0.10532)	0.25428* (0.15205)
Non-random parameters in utility functions		
[redacted]		
COST	-0.01970*** (0.00459)	-0.02276*** (0.00569)
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.02529 (1.19796)	0.01792 (3.08073)
sdCOM_FISH-	0.22300 (0.23840)	0.24000 (0.18841)
sdFISH_POP-	0.15562 (0.62694)	0.16994 (0.24093)
sdFISH_SAV-	0.07500*** (0.02719)	0.16878*** (0.01964)
sdAQUATIC-	0.18606 (0.56830)	0.20625 (0.24925)
Model significance		
Model χ^2	530.78 (d.f. = 21,p<0.0001)	431.31 (d f. = 21,p<0.0001)
Pseudo R^2	0.30	0.28

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

Table 8-8—Results for the Inland Region

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model	Weighted Linear Model
Random parameters in utility functions		
CONSTANT	-0.27285 (0.35114)	-1.06760*** (0.32532)
COM_FISH	0.03287 (0.03484)	0.01225 (0.03726)
FISH_POP	0.07866 (0.05503)	0.06879 (0.05105)
FISH_SAV	0.03008*** (0.00484)	0.03075*** (0.00469)
AQUATIC	0.13923** (0.06464)	0.08659 (0.06120)
Non-random parameters in utility functions		
[redacted]		
COST	-0.03310*** (0.00272)	-0.03845*** (0.00309)
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.12046 (0.89626)	0.21807 (1.01186)
sdCOM_FISH-	0.13940* (0.08217)	0.24216*** (0.08353)
sdFISH_POP-	0.11286 (0.20777)	0.01929 (0.29777)
sdFISH_SAV-	0.05626*** (0.00820)	0.06329*** (0.02133)
sdAQUATIC-	0.48712*** (0.11684)	0.54672 (0.41058)
Model significance		
Model χ^2	1052.33 (d f. = 21, p<0.0001)	1018.72 (d.f. = 21, p<0.0001)
Pseudo R^2	0.22	0.21

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.
[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

Table 8-9—Results for the National Survey Version

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model [c]	Weighted Linear Model
Random parameters in utility functions		
CONSTANT	-0.07173 (0.52799)	-0.14468 (0.41729)
COM_FISH	0.16798*** (0.05393)	0.14066** (0.06122)
FISH_POP	0.22982** (0.09376)	0.22124** (0.09823)
FISH_SAV	0.03105*** (0.00858)	0.03515*** (0.00794)
AQUATIC	0.16707* (0.09305)	0.17247* (0.09718)
Non-random parameters in utility functions		
[redacted]		
COST	-0.03530*** (0.00439)	-0.03654*** (0.00474)
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.00564 (4.40041)	0.00325 (4.70292)
sdCOM_FISH-	0.09311 (0.14591)	0.04477 (0.25521)
sdFISH_POP-	0.07957 (0.27602)	0.06148 (0.40249)
sdFISH_SAV-	0.07604*** (0.01189)	0.08255*** (0.01104)
sdAQUATIC-	0.19750 (0.18475)	0.28067 (0.26163)
Model Specification		
Model χ^2	402.40 (d f. = 21, p<0.0001)	404.74 (d f. = 21, p<0.0001)
Pseudo R^2	0.23	0.23

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.
[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

8.5 Validity Tests

EPA conducted tests to assess the validity of the estimated models. These tests included (1) testing for model sensitivity to scope, [redacted]. The tests and results are described in the following subsections.

8.5.1 Model Sensitivity to Scope

Compared to tests of scope in contingent valuation, the role of external scope tests within choice modeling has received much less attention in the literature (cf., Heberlein et al. 2005). Unlike open-ended contingent valuation questions, choice experiments provide a direct mechanism for respondents to react to the scope and scale of resource changes, by enabling respondents to compare policy options with different levels for each attribute. A scope test looks at whether respondents' WTP is greater for a good that is somehow larger, either in a quantitative or qualitative sense. As noted by Bennett and Blamey (2001, p. 231), "internal scope tests are automatically available from the results of a [choice modeling] exercise."

In other words, choice experiments already include "internal" scope tests because respondents compare levels across Options A and B. Respondents express WTP for incremental improvements in environmental attributes through their selection of No Policy, Option A, or Option B within the choice questions and model results indicate that WTP is higher for an option with a greater level of goods. Within a choice modeling context, external scope tests may also be confounded by differences in the implied choice frame (Bennett and Blamey 2001). These caveats aside, an external scope test can provide some insight into response patterns, and many view these tests as a "stronger" form of validation than internal scope tests. EPA therefore implemented a form of external scope tests to evaluate this form of validity using the mail survey data for each survey region. As the experimental design was not originally conceived to allow formal tests of external scope, the following test is illustrated as an alternative approach that is possible given the current experimental design and available data.

EPA used a split sample to look at respondents' selections for Options A and B separately and obtain a more "external" perspective based on the concept that, if all else is orthogonal (effectively equal), a choice option with more fish saved should be chosen more often than a choice option with fewer fish saved. Splitting out Options A and B provides a more convincing test, because it shows that the same patterns apply to both Options A and B. EPA limited the test to the *fish saved* attribute because fish saved is the only attribute that EPA is using at this time [redacted]. To distinguish this test from the "internal" scope tests automatically performed by choice experiments, it is implemented using a split sample of choice options viewed in isolation. To implement the test, EPA first created a dataset *only* of observations on Option A for all survey responses, along with the dummy (0-1) variable *choice*, indicating whether that option was chosen. EPA then further split this sample into three sub-samples based on the three levels of fish saved assigned to each region within the experimental design. Using the Northeast region as an example, the three sub-samples are: (1) observations on Option A when *fish_sav* = 95%, (2) observations on Option A when *fish_sav* = 50%, and (3) observations on Option A when *fish_sav* =5%. See Table 3-1 for the list of fish saved attribute levels for each survey region. Because of the near orthogonal nature of the experimental design, all other attribute levels should be approximately equal across each of these three sub-samples. Given this split sample, EPA expected to observe the greatest proportion of respondents choosing Option A in sub-sample (1), followed by sub-sample (2) and then (3). This order would establish external sensitivity to scope. EPA then repeated the same test for Option B.

The test results of each region are presented in Table 8-10 through Table 8-14. The results tables illustrate means and standard deviations for *choice* and attributes of each observation of Option A and Option B. The external scope tests for split samples of both Options A and B demonstrate scope sensitivity [redacted] The values of other choice attributes (*com_fish*, *fish_pop*, *aquatic*, and *cost*) are approximately equal over the split samples, as one would expect given the experimental design. The proportion of respondents choosing Option A (*choice*) declines as the percentage of fish saved (*fish_sav*) declines for all survey regions. Using the Northeast as an example, the proportion of respondents choosing Option A (*choice*) declines from 0.45 to 0.42 to 0.25 as the percentage of fish saved (*fish_sav*) declines from 95% to 50% to 5%. Option B exhibits a similar decline in *choice* with *fish_sav* for all survey regions.

[redacted]

Table 8-10—Results of the Split-Sample External Validity Test for the Northeast Survey Data

Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 95%				
CHOICE	**0.4538**	0.4986	**0.4854**	0.5005
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.3866	2.0736	45.3077	2.0187
FISH_POP	28.0560	1.1647	28.5199	1.2591
FISH_SAV	**95.0000**	0.0000	**95.0000**	0.0000
AQUATIC	52.3305	1.2441	52.2334	1.2500
COST	42.3866	20.8902	44.1804	21.7200
Fish Saved = 50%				
CHOICE	**0.4212**	0.4945	**0.4313**	0.4960
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.0630	1.9802	45.4469	2.0762
FISH_POP	28.2493	1.2169	28.4187	1.2742
FISH_SAV	**50.0000**	0.0000	**50.0000**	0.0000
AQUATIC	52.2808	1.2323	52.2906	1.2569
COST	41.8109	20.4754	41.6250	20.6614
Fish Saved = 5%				
CHOICE	**0.2514**	0.4344	**0.2452**	0.4308
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.2938	2.1432	45.3333	2.1172
FISH_POP	28.4379	1.3350	28.3278	1.2054
FISH_SAV	**5.0000**	0.0000	**5.0000**	0.0000
AQUATIC	52.4407	1.2474	52.3636	1.2077
COST	40.0678	19.6789	38.9752	19.8014

The external scope test for the Northeast region was run using 394 observations before the final Northeast dataset was available. An additional 27 observations are included in the final dataset used for model estimation.

Table 8-11—Results of the Split-Sample External Validity Test for the Southeast Survey Data

Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 90%				
CHOICE	**0.4796**	0.5001	**0.4000**	0.4904
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.5656	2.0659	42.4124	2.0059
FISH_POP	26.0667	1.1679	26.5670	1.2704
FISH_SAV	**90.0000**	0.0000	**90.0000**	0.0000
AQUATIC	70.3441	1.2465	70.2206	1.2107
COST	43.1484	20.7845	44.3134	22.2718
Fish Saved = 55%				
CHOICE	**0.3593**	0.4803	**0.2939**	0.4560
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.2208	2.0320	42.4146	1.9992
FISH_POP	26.2987	1.2400	26.3850	1.2496
FISH_SAV	**55.0000**	0.0000	**55.0000**	0.0000
AQUATIC	70.3160	1.2496	70.2916	1.2630
COST	42.2857	19.4351	41.2210	20.4328
Fish Saved = 25%				
CHOICE	**0.2922**	0.4553	**0.2602**	0.4392
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.3095	2.0957	42.1871	2.1146
FISH_POP	26.3658	1.3084	26.2430	1.1740
FISH_SAV	**25.0000**	0.0000	**25.0000**	0.0000
AQUATIC	70.3788	1.2486	70.3204	1.2416
COST	39.8442	19.4299	40.1548	20.1882

Table 8-12—Results of the Split-Sample External Validity Test for the Pacific Survey Data

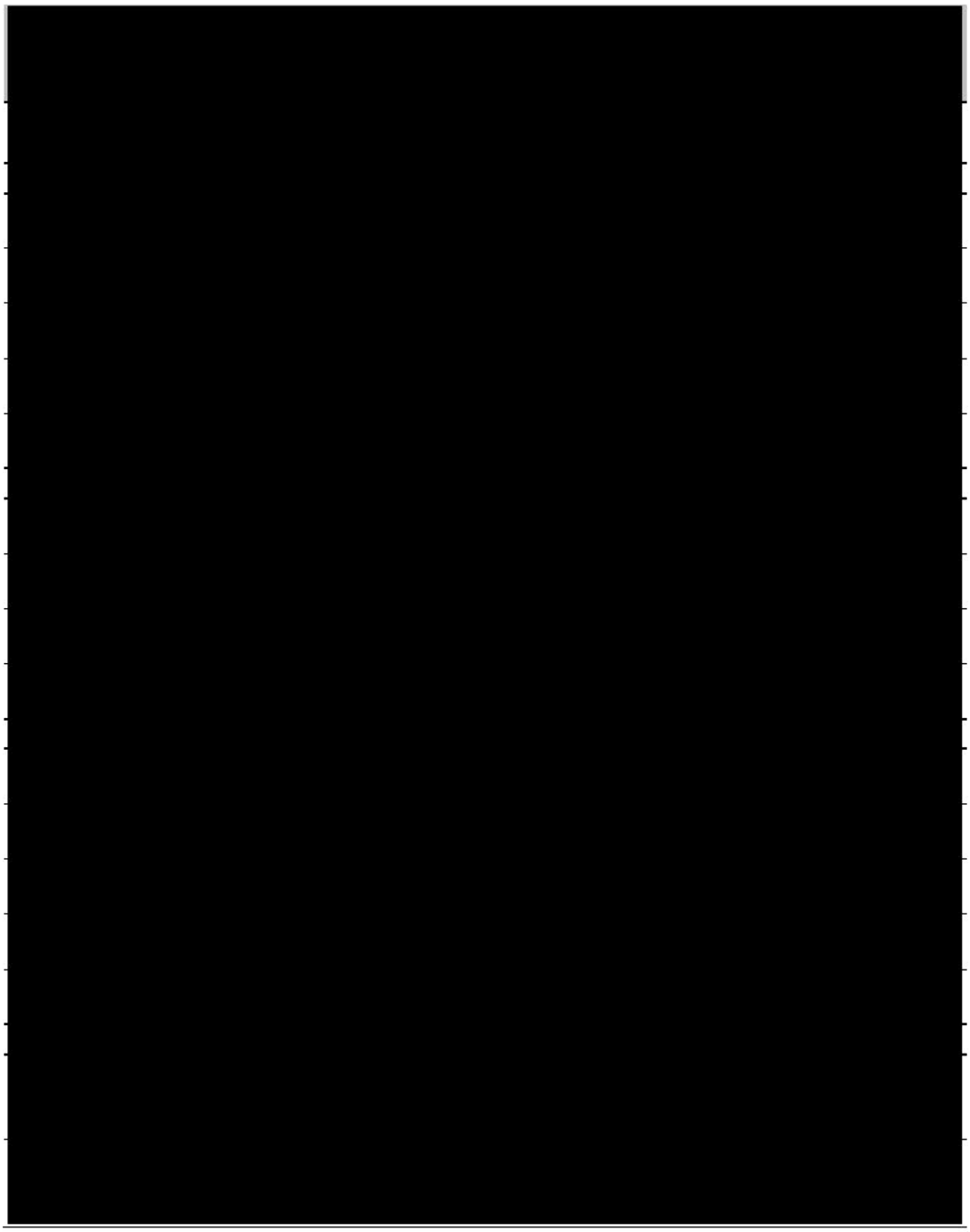
Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 95%				
CHOICE	**0.4929**	0.5008	**0.5993**	0.4909
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	59.6241	2.0563	59.4774	2.0274
FISH_POP	34.1631	1.2057	34.5505	1.2888
FISH_SAV	**95.0000**	0.0000	**95.0000**	0.0000
AQUATIC	53.3582	1.2325	53.1289	1.1770
COST	42.7660	20.7889	43.0244	21.7743
Fish Saved = 50%				
CHOICE	**0.3722**	0.4843	**0.4118**	0.4931
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	59.1579	2.0182	59.4275	2.0239
FISH_POP	34.3120	1.2117	34.2980	1.2156
FISH_SAV	**50.0000**	0.0000	**50.0000**	0.0000
AQUATIC	53.3008	1.2558	53.3059	1.2583
COST	43.5338	18.7381	39.9529	20.4315
Fish Saved = 2%				
CHOICE	**0.1932**	0.3955	**0.2333**	0.4237
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	59.2235	2.1126	59.1556	2.1116
FISH_POP	34.3674	1.3071	34.2963	1.2107
FISH_SAV	**2.0000**	0.0000	**2.0000**	0.0000
AQUATIC	53.4167	1.2458	53.3667	1.2446
COST	39.8636	19.6001	39.7778	20.6196

Table 8-13—Results of the Split-Sample External Validity Test for the Inland Survey Data

Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 95%				
CHOICE	**0.4225**	0.4943	**0.3679**	0.4825
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.5775	2.0535	42.4130	2.0121
FISH_POP	35.1481	1.1673	35.6189	1.2641
FISH_SAV	**95.0000**	0.0000	**95.0000**	0.0000
AQUATIC	44.3580	1.2610	44.2151	1.1857
COST	43.4733	20.8286	45.0518	22.2079
Fish Saved = 75%				
CHOICE	**0.3897**	0.4880	**0.3234**	0.4681
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.1935	2.0664	42.4068	2.0067
FISH_POP	35.3126	1.2346	35.3630	1.2346
FISH_SAV	**75.0000**	0.0000	**75.0000**	0.0000
AQUATIC	44.2815	1.2382	44.2938	1.2569
COST	42.9824	19.3645	41.0847	20.3182
Fish Saved = 55%				
CHOICE	**0.3652**	0.4818	**0.2712**	0.4449
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	42.2795	2.0580	42.2045	2.1311
FISH_POP	35.4031	1.3309	35.1878	1.1894
FISH_SAV	**55.0000**	0.0000	**55.0000**	0.0000
AQUATIC	44.4115	1.2665	44.3894	1.2705
COST	39.5730	19.2038	39.8887	20.5297

Table 8-14—Results of the Split-Sample External Validity Test for the National Survey Data

Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 95%				
CHOICE	**0.4753**	0.5003	**0.4604**	0.4994
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	54.5019	2.0301	54.5321	2.0394
FISH_POP	32.0418	1.1731	32.5585	1.2299
FISH_SAV	**95.0000**	0.0000	**95.0000**	0.0000
AQUATIC	55.3536	1.2296	55.2340	1.2178
COST	42.0684	20.9393	44.1057	22.5238
Fish Saved = 55%				
CHOICE	**0.3571**	0.4801	**0.3013**	0.4598
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	54.3647	2.0973	54.4226	1.9557
FISH_POP	32.2368	1.1945	32.4142	1.2768
FISH_SAV	**55.0000**	0.0000	**55.0000**	0.0000
AQUATIC	55.3647	1.2584	55.3933	1.2818
COST	41.0977	20.0392	40.1172	19.8597
Fish Saved = 25%				
CHOICE	**0.3269**	0.4700	**0.2737**	0.4466
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	54.3000	2.0708	54.2561	2.1315
FISH_POP	32.5231	1.3135	32.2281	1.1870
FISH_SAV	**25.0000**	0.0000	**25.0000**	0.0000
AQUATIC	55.3769	1.2598	55.2702	1.2478
COST	39.3231	19.3014	40.7158	19.8868



9 Estimation of Implicit Prices and WTP

9.1 Estimation of Implicit Prices

EPA used the results of the random utility models described in Section 8.3 to estimate the marginal annual WTP (or implicit price) for a one percentage point change in each of the four environmental attributes within each survey region. This represents WTP per household, per year, for a one percentage point change in the corresponding choice model attribute. For example, one could calculate the marginal WTP for each additional percentage increase in fish saved, holding all else constant. If utility is modeled

as a linear function of attributes, implicit prices may be calculated as $IP_a =$, where β_a is the

estimated coefficient on a non-monetary attribute (e.g., change in fish saved), and β_n is the coefficient on program cost.[25]

Assuming a linear preference function as estimated above, compensating surplus (or household WTP) for any given policy option may be calculated as:[26]

(Eq. 6) CS =

where $a=1...A$ represents the number of distinct non-price attributes in the model, and is the change in attribute a resulting from the policy. Relevant attributes are *com_fish*, *fish_pop*, *fish_sav* and *aquatic* (see Table 8-1 for variable definitions). Compensating surplus for any non-status quo policy option is calculated as:

(Eq. 7) CS =

where the delta ( ) represents a change in the attribute in question.[27] That is, total WTP for a policy change is calculated as the sum of the product of implicit prices and corresponding attribute changes. The implicit price for the ASC (*constant*) was excluded when calculating compensating surplus because it was found to be insignificant during model estimation. See Section 8.1for additional discussion of the ASC and its interpretation.

EPA notes that ecological systems are typically characterized by correlation among many processes and outcomes. In the context of impingement and entrainment losses, for example, a reduction in A1E losses (*fish_sav*) maybe correlated with changes in fish populations (*fish_pop*), aquatic ecosystem condition (*aquatic*), and commercial fish populations (*com_fish*). Were the SP survey scenarios to incorporate the same correlations, it would be difficult to determine which attribute(s) caused respondents to choose one scenario over another. For example, if large reductions in I&E losses always accompany large positive effects on fish populations and large positive effects on ecosystem condition within survey scenarios (and vice versa), it would be difficult to estimate the relative influence of each effect on respondents' choices.

The experimental design used in the SP survey breaks this correlation, allowing different survey attributes to vary independently. This enables different respondents to view many different possible policy outcomes, each with different combinations of *fish_sav*, *fish_pop*, *aquatic,* and *com_fish*. While some of the resulting scenarios might be unlikely in actual aquatic systems, they are not ecologically impossible. For example, the experimental design allows respondents to consider scenarios in which large reductions in fish losses accompany small changes in fish populations and aquatic condition (positive changes in *fish_sav* in some questions are also paired with no change in the population or aquatic condition metrics). Because attributes vary independently across the 72 different choice questions presented to respondents in each survey region, it is possible to estimate the unique effects of each attribute on individuals' choices

25 [redacted]

26 EPA excluded the ASC when estimating the benefits of regulatory options. [redacted]

27 [redacted]

and, therefore, values. By breaking the correlation between these attributes present in ecosystems, the choice experiment design allows estimation of the independent effect of each attribute on choices and WTP.

These attributes have almost zero correlation in the resulting experimental design. It is thus possible to obtain precise (i.e., efficient) estimates of each effect, without concerns that these estimates are confounded by correlations among the ecological outcomes in the survey. This allows WTP for each ecological effect to be estimated, independent from all other effects.

Because the mixed logit model includes random coefficients, EPA estimated implicit prices using the welfare simulation approach of Johnston and Duke (2007; 2009) following the framework outlined by Hensher and Greene (2003). The procedure begins with a parameter simulation following the parametric bootstrap of Krinsky and Robb (1986), with R=1000 draws taken from the mean parameter vector and associated covariance matrix. For each draw, the resulting parameters are used to characterize asymptotically normal empirical densities for fixed and random coefficients. For each of these R draws, a coefficient simulation is then conducted for each random coefficient, with S=1000 draws taken from simulated empirical densities. Here, all coefficient simulations draw from a normal distribution except for that on *cost*, which is fixed. EPA calculated WTP measures for each draw, resulting in a combined empirical distribution of $R \times S$ observations from which summary statistics were derived. All implicit prices are modeled as the WTP for a one percentage point change in the ecological attribute, all else being constant. The resulting empirical distributions accommodate both the sampling variance of parameter estimates and the estimated distribution of random parameters. EPA followed Hu et al. (2005) and simulated welfare estimates as the mean over the parameter simulation of mean WTP calculated over the coefficient simulation (i.e., mean of mean WTP).

The resulting mean implicit prices and 90% confidence intervals for the ASC (constant) and environmental attributes in each region are presented in Table 10-1. [redacted] The point estimates for implicit prices tend to be larger for commercial fish populations, fish populations (all fish), and aquatic ecosystem condition than fish saved, although the statistical significance of these point estimates varies. Hence, some point estimates that appear large may not be statistically significant, and vice versa. In the Northeast, for example, households value a one percentage point increase in commercial fish populations or aquatic ecosystem condition about eight times more than a one percentage point increase in fish saved for the unweighted linear model. The mean implicit prices for a 1% improvement in fish saved under the weighted linear models range from $0.81 in the Inland region to $3.90 in the Pacific region.

Although the discussion in this section refers to WTP for a percentage point increase in fish saved, it is important to note that this variable represents a one percentage point reduction relative to the baseline mortality (e.g., the Northeast survey booklet indicated a baseline loss of 1.1 billion fish). This relationship between the percentage point reduction and cardinal fish losses was specified clearly in the survey questions, and the same relationship was maintained throughout each survey version. Again, using the Northeast survey as an example, EPA is presenting the WTP for a percentage point reduction of mortality that is associated with a specific absolute quantity of fish out of 1.1 billion fish, rather than a general, relative reduction of 1% from an unspecified level of I&E mortality. The regional and national surveys have different baseline fish losses. EPA expected survey responses to vary across the regions, both because residents might have different values, and because baseline losses differ.

Table 9-1—Estimated Implicit Prices for a One Percentage Point Change in Each Attribute, WTP per household, per Year (2011$)

Region/Attribute	Linear Model			Weighted Model		
	Mean [a]	90% Confidence Interval		Mean	90% Confidence Interval	
		5th	95th		5th	95th
Northeast						
ASC (*CONSTANT*)	-$4.77	-$19.24	$10.23	-$9.76	-$40.97	$24.66
Commercial Fish Populations (*COM_FISH*)	$8.78	$5.94	$12.08	$7.81	$3.35	$13.51
Fish Populations (all fish) (*FISH_POP*)	$3.12	$0.83	$7.02	$3.47	-$4.10	$11.30
Fish Saved (*FISH_SAV*)	$0.99	$0.57	$1.43	$1.32	$0.80	$1.93
[redacted]						
Aquatic Ecosystem condition (*AQUATIC*)	$8.54	$3.23	$14.13	$9.79	$1.78	$18.49
Southeast						
ASC (*CONSTANT*)	$4.60	-$9.69	$19.51	-$0.96	-$18.43	$16.73
Commercial Fish Populations (*COM_FISH*)	$5.69	$3.62	$8.13	$5.61	$3.25	$8.29
Fish Populations (all fish) (*FISH_POP*)	$3.84	$1.01	$6.87	$2.03	-$1.68	$5.86
Fish Saved (*FISH_SAV*)	$0.64	$0.38	$0.90	$0.83	$0.51	$1.16
[redacted]						
Aquatic Ecosystem condition (*AQUATIC*)	$6.95	$3.92	$9.84	$6.62	$2.83	$10.42
Pacific						
ASC (*CONSTANT*)	$11.77	-$24.36	$$47.97	$8.92	-$33.74	$51.09
Commercial Fish Populations (*COM_FISH*)	$4.88	-$1.63	$12.09	$3.25	-$4.72	$11.86
Fish Populations (all fish) (*FISH_POP*)	$6.21	-$2.77	$14.87	$4.69	-$6.76	$15.12
Fish Saved (*FISH_SAV*)	$3.27	$2.16	$4.81	$3.90	$2.37	$6.02
[redacted]						
Aquatic Ecosystem condition (*AQUATIC*)	$11.48	$2.71	$20.14	$11.31	$0.50	$22.71
Inland						
ASC (*CONSTANT*)	$8.19	-$25.49	$8.98	-$27.74	-$41.80	-$13.74
Commercial Fish Populations (*COM_FISH*)	$0.99	-$0.70	$2.78	$0.31	-$1.26	$1.96
Fish Populations (all fish) (*FISH_POP*)	$2.34	-$0.35	$5.19	$1.76	$0.45	$4.06
Fish Saved (*FISH_SAV*)	$0.92	$0.66	$1.16	$0.81	$0.59	$1.01
[redacted]						
Aquatic Ecosystem condition (*AQUATIC*)	$4.18	$0.98	$7.39	$2.22	-$0.51	$5.01
National						
ASC (*CONSTANT*)	-$1.98	-$27.12	$23.59	-$3.89	-$23.59	$16.13
Commercial Fish Populations (*COM_FISH*)	$4.77	$2.35	$7.47	$3.87	$1.09	$6.81
Fish Populations (all fish) (*FISH_POP*)	$6.45	$2.16	$10.69	$6.02	$1.61	$10.45
Fish Saved (*FISH_SAV*)	$0.90	$0.47	$1.32	$0.98	$0.59	$1.38
[redacted]						
Aquatic Ecosystem condition (*AQUATIC*)	$4.70	$0.37	$9.06	$4.76	$0.14	$9.42

[a] The implicit prices are per percentage point increase from the specified baseline (reference) levels. They are not directly transferable to scenarios with alternative baseline levels.

[redacted]

10 Results for Regulatory Options

EPA used the implicit prices presented in Table 9-1 to estimate annual monetized benefits for the survey regions and total U.S. households under regulatory options. The analysis is of regulatory options and I&E reductions that were included in the analysis for the proposed rule. The set of regulatory options may change for the final 316(b) rule. The four regulatory options from the proposed rule analysis are:

- Option 1 – Impingement limitations based on modified traveling screens for all facilities with flow greater than 2 million gallons per day (MGD)
- Option 2 – Intake flow commensurate with closed-cycle cooling for facilities that have a design intake flow of greater than 125 MGD and impingement limitations based on modified traveling screens for all facilities with flow greater than 2 MGD
- Option 3 – Intake flow commensurate with closed-cycle cooling for all facilities and impingement limitations based on modified traveling screens for all facilities with flow greater than 2 MGD
- Option 4 – Impingement limitations based on modified traveling screens for all facilities with flow greater than 50 MGD.

EPA estimated the annual benefits of regulatory options based solely on changes in fish saved.

Table 10-1 presents the marginal change in fish saved for each region and the nation under the four regulatory options presented in the proposed rule. Table 10-2 presents the associated mean WTP per household for each region and regulatory option. The marginal change in fish saved (%) for each regulatory option is calculated based on the percentage reduction in A1E losses relative to baseline A1E losses due to impingement and entrainment within the survey region. For its 316(b) analyses, EPA standardized all I&E mortality losses into equivalent numbers of 1-year-old fish, a value termed age-1 equivalents (A1Es). This conversion allows losses to be compared among species, years, facilities, and regions. The regions for the SP survey differ from the benefits regions used for the analysis of the proposed rule. EPA applied state-level data for facility actual intake flow (AIF) to regional I&E reductions from the proposed rule to estimate I&E reductions for the survey regions. EPA used AIF because operational flow is the most important factor in the benefits analysis; I&E mortality losses are a function of intake flow. Changes in commercial fish populations, fish populations (all fish), and aquatic ecosystem condition could also factor into the calculation of household WTP, if EPA were able to model changes in these drivers of WTP.[28]

During development of the proposed rule, the state of California released I&E technology requirements on coastal electric power plants. To account for this state regulation, EPA excluded coastal electric power plants in California when calculating reductions in I&E mortality under regulatory options for the proposed rule. However, EPA determined that the Pacific survey should include these facilities because of the Agency's need to develop benefits estimates for various potential regulatory options encompassing different technology and implementation schedules (which could potentially be more strict than the current California policy). The choice of this baseline also alleviated the potential for respondent confusion if they had been presented with maps in the survey booklets that had no California coastal

[28] The experimental design utilized in EPA's survey ameliorates the problem of correlation between estimated model attributes. The actual correlation among the ecological attributes, such as fish saved and aquatic condition, would be accounted for in the predicted attribute changes used (in conjunction with the estimated model coefficients) for benefits estimation.

facilities. Since EPA is using I&E reductions from the proposed rule, A1E losses associated with California coastal power plants are excluded from the numerator when calculating percent fish saved. The exclusion of these facilities from the numerator is the reason that percent fish saved is much lower for the Pacific region than other survey regions.[29] See Table 10-1 for estimated A1E reductions and percent fish saved for all survey regions and proposed regulatory options.[30]

The average annual household WTP under each regulatory option is calculated by multiplying the estimated percentage change in fish saved by the implicit price, or WTP per percentage point change, in fish saved (*fish_sav*) as presented in Table 9-1. [redacted] As Table 10-2 shows, the mean estimated WTP per household under the weighted linear model varies across regions and regulatory options, ranging from $1.75 for Option 4 in the Pacific region to $122.73 for Option 3 in the Northeast region. The WTP values per household tend to vary across the regions and options in expected ways. The WTP for Options 2 and 3, which would include more entrainment controls, is significantly larger in the coastal regions, where entrainment is more of an issue. Likewise, there is relatively less variability across the options for the Inland region. Most of the baseline impacts in this region are due to impingement, which is roughly equally protected across the options.

[29] EPA provided additional detail on the calculation of percent fish saved for the Pacific region in a memorandum to the 316(b) Existing Facilities Rule record (Helm 2012).

[30] Since EPA released the proposed rule, New York State has implemented a policy outlining I&E technology requirements for in-state waters. The A1E reductions and percent fish saved presented in this document are based on the proposed rule; therefore, they do not account for the New York policy. EPA will consider the New York policy in its analysis for the final rule.

Table 10-1—Reduction in A1E Losses and Fish Saved (%) by Survey Version and Regulatory Option

Survey Version and Regulatory Option	Reduction in A1E Losses	Fish Saved (%)
Northeast		
Eliminating Baseline I&E Mortality Losses [a]	964.87	100.00
Option 1	78.31	8.12
Option 2	880.70	91.28
Option 3	893.73	92.63
Option 4	77.29	8.01
Southeast		
Eliminating Baseline I&E Mortality Losses	722.97	100.00
Option 1	271.41	37.54
Option 2	642.28	88.84
Option 3	651.70	90.14
Option 4	265.86	36.77
Pacific [b]		
Eliminating Baseline I&E Mortality Losses	385.99	100.00
Option 1	1.78	0.46
Option 2	33.28	8.62
Option 3	34.74	9.00
Option 4	1.73	0.45
Inland		
Eliminating Baseline I&E Mortality Losses	462.29	100.00
Option 1	263.48	56.99
Option 2	425.29	92.00
Option 3	433.38	93.75
Option 4	257.54	55.71
National Version		
Eliminating Baseline I&E Mortality Losses	2536.13	100.00
Option 1	614.97	24.25
Option 2	1981.55	78.13
Option 3	2013.55	79.39
Option 4	602.42	23.75

[a] This hypothetical scenario reflects the benefits that would be achieved if all I&E mortality losses were eliminated. EPA includes it to allow comparison of regulatory option benefits to total baseline I&E mortality losses. This scenario was listed as "Baseline I&E Losses" in the EEBA for the proposed rule (USEPA 2011a).

[b] The calculation of fish saved (%) for the Pacific survey region includes reductions in A1E losses at Hawaii facilities. This approach is consistent with the EEBA, which included Hawaii facilities in the California region. EPA did not apply household WTP to Hawaii households when estimating regulatory benefits because Hawaii households were not included in the mail survey sample.

Regulatory Scenarios: Option 1 = Impingement mortality (IM) limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 2 = Intake flow commensurate with closed-cycle cooling for facilities that have a design intake flow of greater than 125 MGD and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 3 = Intake flow commensurate with closed-cycle cooling for all facilities and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 4 = IM limitations based on modified traveling screens for all facilities with flow greater than 50 MGD.

Table 10-2— WTP per Household per Year by Regulatory Option (2011$)

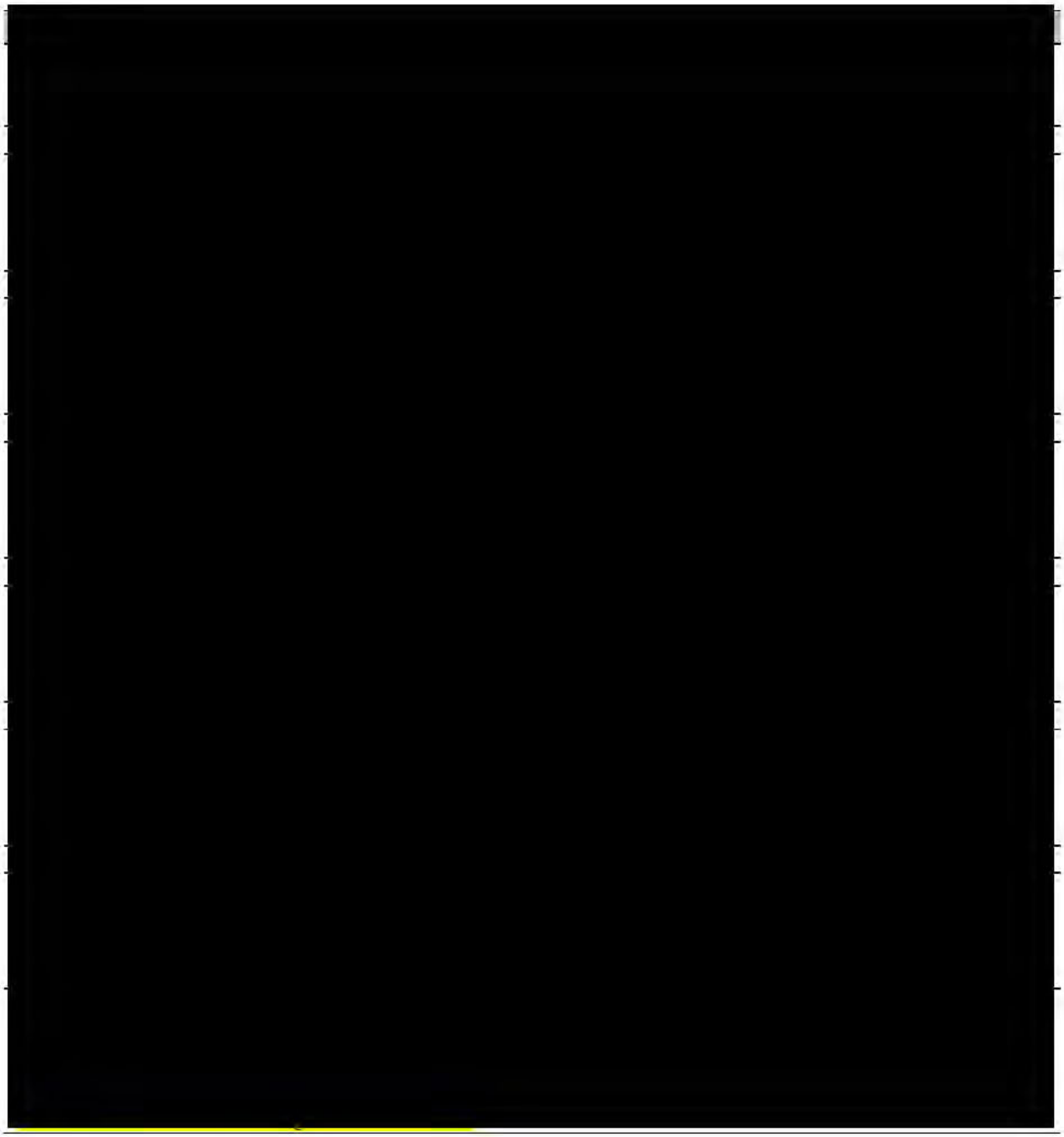
Survey Version and Regulatory Option	Linear Model			Weighted Linear Model		
	5th	Mean	95th	5th	Mean	95th
Northeast						
Option 1	$4.65	$8.02	$11.63	$6.48	$10.75	$15.68
Option 2	$52.26	$90.17	$130.78	$72.89	$120.94	$176.39
Option 3	$53.03	$91.51	$132.72	$73.97	$122.73	$179.00
Option 4	$4.59	$7.91	$11.48	$6.40	$10.61	$15.48
Southeast						
Option 1	$14.32	$23.88	$33.67	$19.01	$31.09	$43.42
Option 2	$33.89	$56.52	$79.67	$44.98	$73.58	$102.74
Option 3	$34.39	$57.35	$80.84	$45.64	$74.66	$104.25
Option 4	$14.03	$23.39	$32.98	$18.62	$30.46	$42.53
Pacific [b]						
Option 1	$0.99	$1.51	$2.22	$1.09	$1.80	$2.77
Option 2	$18.62	$28.20	$41.50	$20.46	$33.63	$51.95
Option 3	$19.43	$29.44	$43.32	$21.36	$35.10	$54.23
Option 4	$0.97	$1.47	$2.16	$1.06	$1.75	$2.70
Inland						
Option 1	$37.67	$52.27	$66.25	$33.87	$45.90	$57.50
Option 2	$60.80	$84.37	$106.93	$54.66	$74.09	$92.81
Option 3	$61.96	$85.97	$108.97	$55.70	$75.50	$94.57
Option 4	$36.82	$51.09	$64.75	$33.10	$44.87	$56.20
National Version						
Option 1	$11.33	$21.80	$31.91	$14.29	$23.80	$33.35
Option 2	$36.49	$70.24	$102.82	$46.05	$76.68	$107.44
Option 3	$37.08	$71.38	$104.48	$46.79	$77.92	$109.18
Option 4	$11.09	$21.36	$31.26	$14.00	$23.31	$32.66

Regulatory Scenarios: Option 1 = IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 2 = Intake flow commensurate with closed-cycle cooling for facilities that have a design intake flow of greater than 125 MGD and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 3 = Intake flow commensurate with closed-cycle cooling for all facilities and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 4 = IM limitations based on modified traveling screens for all facilities with flow greater than 50 MGD.

Annual household WTP under each regulatory option was multiplied by the number of households in the region based on Census 2010 to calculate total WTP for fish saved within the region.[31] WTP was then discounted based on the regulatory compliance schedule. The compliance schedule is a time profile that reflects when benefits from each facility will be realized, incorporating both the implementation timeline of the 316(b) rule and biological considerations. The implementation timeline is based on the promulgation date of the rule and the date at which facilities are expected to implement new technology required under the 316(b) rule. EPA did not include a biological lag in the estimation of regulatory benefits (i.e., percent fish saved) to maintain consistency with materials presented to the survey respondents. The 316(b) survey described I&E losses as fish losses that include various life stages (including eggs, larvae, and adult fish). Therefore, respondents are expected to value prevention of fish losses at the life stage at which the losses occur and, as a result, no biological lag is necessary.[32] A separate compliance schedule was estimated for each 316(b) region for the proposed rule. As stated previously, the boundaries of the SP survey regions differ slightly from the proposed rule regions. Because regional I&E mortality losses are a function of operational intake flow, EPA accounted for differences in regional boundaries by adjusting the proposed rule compliance schedule based on state-level AIF data by waterbody type (i.e., coastal/estuarine or freshwater). Refer to Appendix D of the EEBA for the proposed rule (USEPA 2011a) for additional description of the compliance schedule

[31] EPA updated the household totals based on Census 2010. They are slightly greater than totals presented in Table 5-1, that were used for developing the survey sample, which were based on the 2005-2007 ACS.

[32] A biological time lag would be needed in the analysis of commercial and recreational fishing benefits to account for time needed for fish to achieve a harvestable size.



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Appendix A: Survey Example

As described in Section 3, the experimental design included 24 versions for each of the survey regions (Northeast, Southeast, Pacific, and Inland) and the national survey. This appendix presents version 1 of the Northeast regional survey as an example of the survey format. Within each region and for the national survey, the only differences across the 24 survey versions is the combination of attribute levels presented for Options A and B in the three choice questions (survey questions 4 through 6). See Appendix B for the attribute levels included in each of the 24 versions for the regional and national surveys. The survey format is the same for all regions and the national survey. Differences in the introductory and supporting materials across the regional and national surveys are listed below:

- *Cover* – The survey subtitle and state list are tailored to the respondent's region. The national survey is subtitled "A Survey of US Households" and does not list states.
- *Page 2* – The map is restricted in the regional surveys to show only the respondent's region. The map in the national survey shows all states.
- *Page 3* – The commercial and recreational species listed are tailored to the respondent's region.
- *Page 4* – The estimated range of baseline fish saved and fish saved under policies is tailored to the respondent's region.
- *Page 5* – The text and charts describing policy effects reflect estimates for the respondent's region.
- *Page 7* – The current scores presented in the table defining the environmental attributes reflect the respondent's region.
- *Page 10* – The map is restricted in the regional surveys to show only the respondent's region. The map in the national survey shows all states.

OMB Control No. 2040-0283
Approval expires 07/31/2013

Fish and Aquatic Habitat

A Survey of Northeast Residents

(CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)

HUMAN ACTIVITIES, AQUATIC HABITAT AND FISH

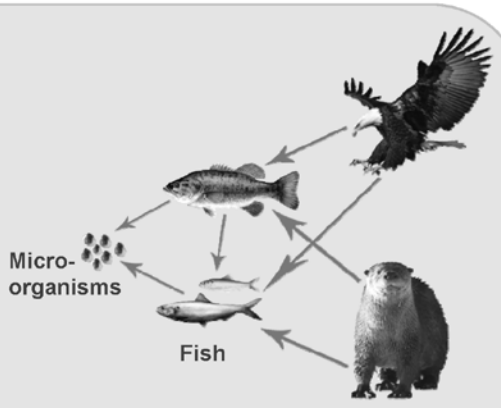
This survey asks for your opinions regarding policies that would affect fish and habitat in the Northeast U.S. Your answers will help the government decide which policies will be enacted. Background information in this survey was provided by the National Marine Fisheries Service, U.S. Environmental Protection Agency, U.S. Geological Survey and other state and federal offices.

Northeast fresh and salt waters support billions of fish. These include fish that are used by humans, as well as forage fish that are not used by humans, but serve as food for larger fish, birds, and animals.

Natural factors such as weather have always influenced fish, but in recent years human activities have had an increasing effect.

Activities that affect fish include fishing, pollution, commercial and residential development, and the extraction of cooling water at industrial facilities.

Declines in fish can affect the condition of ecological systems, food webs, and related human uses such as fishing.



Food Web

This survey concerns proposed policies that would reduce fish losses caused by cooling water use by industrial facilities, including factories and power plants. These policies would benefit aquatic ecosystems but would increase the costs of some goods and services you buy, including electricity and common household products.

HOW DOES COOLING WATER AFFECT FISH?

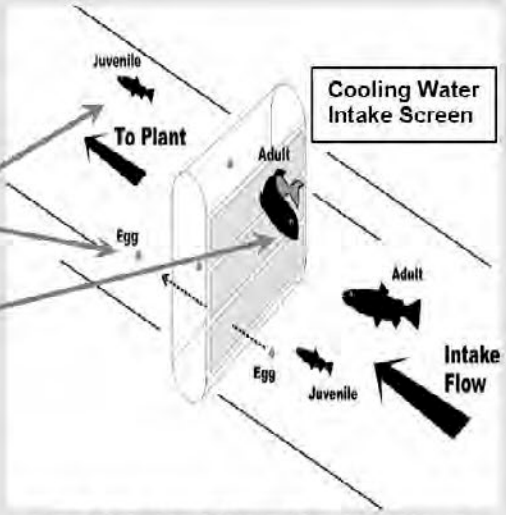
The water that industrial facilities use to cool equipment is pumped from bays, rivers, and lakes. The largest amount is used by power plants that produce electricity.

The equipment that pumps the cooling water kills small fish and fish eggs.

Juvenile fish and eggs move through screens and into the cooling system where they are killed by high temperature.

Large fish may be injured or killed against screens or filters.

Pumping warm water back into the environment (called *thermal discharge*) also affects ecological systems.



How Fish Are Affected by Water Intake

Cooling water use affects fresh and salt waters throughout the Northeast US, but 93% of all fish losses are in coastal bays, estuaries, and tidal rivers.

2

WHAT KINDS OF FISH ARE AFFECTED BY COOLING WATER USE?

Cooling water use is **not** the largest cause of fish loss in most areas (fishing causes greater losses), but has affected some fish populations.

About 1/6 of the fish lost are species caught by commercial and recreational fishermen. Examples include striped bass, flounder, and cod.

The other 5/6 of the fish lost are forage species not caught by humans but serve as food for larger fish, birds, and animals. Examples include killifish, silverside, and stickleback.

Question 1. When thinking about how industrial facilities use cooling water, please rate the importance of the following to you. Check one box for each.

	Not Important		Somewhat Important		Very Important
1. Preventing the loss of fish that are caught by humans	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
2. Preventing the loss of fish that are not caught by humans	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
3. Maintaining the ecological health of rivers, lakes and bays	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
4. Keeping the cost of goods and services low	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
5. Making sure there is enough government regulation of industry	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
6. Making sure there is not too much government regulation of industry	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

HOW MANY FISH ARE AFFECTED?

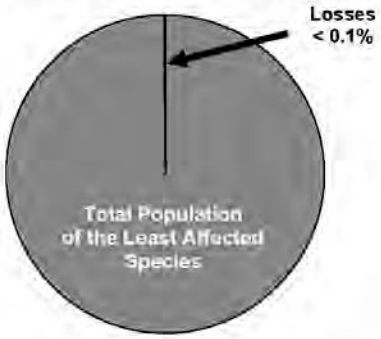
After accounting for the number of eggs and larvae that would be expected to survive to adulthood, scientists estimate that the equivalent of about 1.1 billion young adult fish (the equivalent of one year old) are lost each year in Northeast coastal and fresh waters due to cooling water use.

Scientists can predict the number of these fish that will be saved under different policies. This number ranges from less than 0.1 to 1.0 billion fish saved per year.

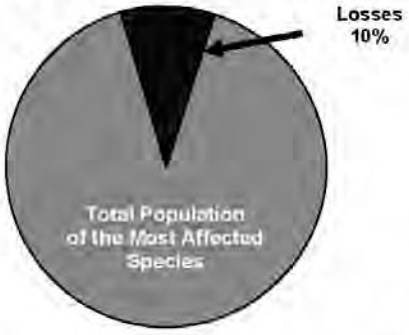
For commercial fish species, losses of young fish in cooling water intakes vary by species, from the equivalent of less than 0.1% to about 10% of a species' total population.

Scientists expect the yearly effects on other fish species are in the same 0.1% to 10% range. The number of young fish lost in cooling water intakes relative to the total number of fish in the water is relatively high for some species, but low for others.

Smallest Commercial Fish Losses per Year



Largest Commercial Fish Losses per Year

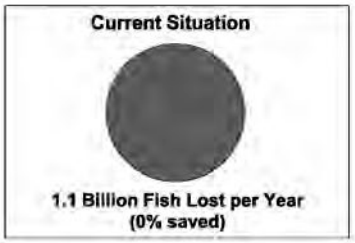


Although scientists can predict the number of fish saved each year, the effect on fish populations is uncertain. This is because scientists do not know the total number of all fish in Northeast waters and because many factors – such as cooling water use, fishing, pollution and water temperature – affect fish.

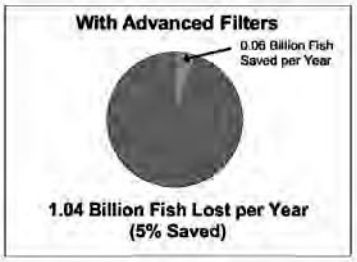
The following page provides information on policies that would be required to reduce these fish losses.

NEW REGULATIONS ARE BEING PROPOSED TO PROTECT FISH

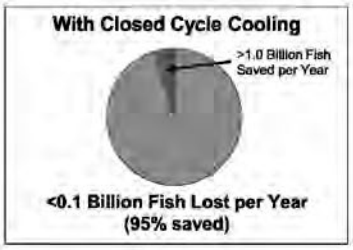
The government is considering new policies to improve the protection of fish.



One policy would require **advanced filters** that block fish from entering cooling water facilities. Requiring advanced filters could reduce fish losses about 5%.



Another possibility is **closed cycle cooling** that recycles and reuses cooling water, so that less water is needed. Requiring closed cycle cooling could reduce fish losses by 95% and also reduces thermal discharge. However, costs are higher than for advanced filters.



Advanced filters and closed cycle cooling are already in use at many facilities and are proven technologies. **New regulations would require a mix of advanced filters and closed cycle cooling at all facilities—with reductions in fish losses between 5% and 95%.**

5

HOW IMPORTANT ARE THESE ISSUES TO YOU?

While these policies would reduce fish losses, they would also increase the costs of producing many goods and services — these costs would be passed on to consumers like you.

Question 2. Compared to other issues that the government might address—such as public safety, education and health—how important is protecting aquatic ecosystems to you? Check one box.

	Not Important		Somewhat Important		Very Important
Protecting aquatic ecosystems is	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

The government needs to know whether households are willing to pay the costs of these new policies.

This survey will ask you to compare policies with different effects on cooling water use, fish, and costs to your household. You will be asked to vote for the options you prefer.

You will also have the opportunity to support the current situation, with no new policies, and no new costs to your household.

6

THIS SURVEY IS SIMILAR TO A PUBLIC VOTE

The next part of this survey will ask you to consider different types of policies to protect fish, and indicate how you would vote. Effects of each possible policy will be described using the following scores:

Effect of Policy	What It Means
 **Commercial Fish Populations** (Fish Used by People)	A score between 0 and 100 percent showing **the overall health of commercial and recreational fish populations**. Higher scores mean more fish and greater fishing potential. A score of 100 means that these fish populations are at a size that maximizes long-term harvest; 0 means no harvest. **The current score in Northeast waters is 42.**
 **Fish Populations** (All Fish)	A score between 0 and 100 percent showing **the estimated size of all fish populations** compared to natural levels without human influence. A score of 100 means that populations are the largest natural size possible; 0 means no fish. **The current score in Northeast waters is 26.**
 **Fish Saved** (per Year)	A score between 0 and 100 percent showing the **reduction in young fish lost** compared to current levels. A score of 100 would mean that no fish are lost in cooling water intakes (all fish would be saved because of the new policy). **The current score in Northeast waters is 0.** This represents the status quo (no policy) with about 12% of plants already using advanced cooling systems.
 **Condition of Aquatic Ecosystems**	A score between 0 to 100 percent showing **the ecological condition of affected areas**, compared to the most natural waters in the Northeast. The score is determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions. Higher scores mean the area is more natural. **The current score in Northeast waters is 50.**
$ **Cost per Year**	How much the policy will **cost your household, in unavoidable price increases for products and services you buy, including electricity and common household products.**

HOW WOULD YOU RATE THE IMPORTANCE OF THESE EFFECTS?

Question 3. When considering policies that affect how facilities use cooling water, how important to you are effects on each of the following scores? Check one box for each. (For reminders of what the scores mean, please see page 7).

	Not Important		Somewhat Important		Very Important
1. Effect on **commercial fish populations**	☐1	☐2	☐3	☐4	☐5
2. Effect on the **fish populations (for all fish)**	☐1	☐2	☐3	☐4	☐5
3. Effect on **fish saved**	☐1	☐2	☐3	☐4	☐5
4. Effect on the **condition of aquatic ecosystems**	☐1	☐2	☐3	☐4	☐5
5. Effect on **cost to my household**	☐1	☐2	☐3	☐4	☐5

The next questions will ask you to choose between different policy options that would affect fish losses in cooling water systems. You will be given choices and asked to vote for the choice you prefer by checking the appropriate box. Questions will look similar to the sample on the next page.

SAMPLE QUESTION

Questions will look like the sample below.

Policy Effect	Current Situation (No policy)	Option A	Option B
 **Commercial Fish Populations** **(in 3-5 Years)**	42% (100% is populations that allow for maximum harvest)	45% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)
 **Fish Populations (all fish)** **(in 3-5 Years)**	26% (100% is populations without human influence)	27% (100% is populations without human influence)	28% (100% is populations without human influence)
 **Fish Saved per Year** **(Out of 1.1 billion fish lost in water intakes)**	0% No change in status quo	5% <0.1 billion fish saved	50% 0.6 billion fish saved
 **Condition of Aquatic Ecosystems** **(in 3-5 Years)**	50% (100% is pristine condition)	51% (100% is pristine condition)	52% (100% is pristine condition)
$ **Increase in Cost of Living for Your Household**	$0 No cost increase	$36 **per year** ($3 per month)	$72 **per year** ($6 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	X I would vote for **NO POLICY**	X I would vote for **OPTION A**	X I would vote for **OPTION B**

If you do not want A or B, check this box

If you prefer **Option A,** check this box

If you prefer **Option B,** check this box

9

AS YOU VOTE PLEASE REMEMBER

- The map below shows the facilities and areas that would be affected by the proposed policies.
- The policy options (A and B) given to you each require a different mix of advanced filters and closed cycle cooling in different areas, so effects on fish are different.
- You will be shown different questions, with different combinations of technology and different costs
- Depending on the policies chosen, costs to your household could range from $0 per year to a maximum of $72 per year (from $0 per month to a maximum of $6 per month).
- Depending on the type of technology required and other factors, effects on fish and ecosystems may be different—even if the annual reduction in fish losses is similar.
- Consider each pair of policy options separately—<u>do not add them up or compare programs from different pages</u>.
- Scientists expect that effects on the environment and economy not shown explicitly will be small. For example, studies of industry suggest that effects on employment will be close to zero.
- Your votes are important. Answer all questions as if this were a real, binding vote.

10

Question 4. Assume that Options A and B would require a different mix of filters and closed cycle cooling in different areas. Assume all types of fish are affected. How would you vote?

Policy Effect NE Waters	Current Situation (No policy)	Option A	Option B
 **Commercial Fish Populations** (in 3-5 Years)	42% (100% is populations that allow for maximum harvest)	45% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)
 **Fish Populations (all fish)** (in 3-5 Years)	26% 100% is populations without human influence)	30% (100% is populations without human influence)	27% (100% is populations without human influence)
 **Fish Saved per Year** (Out of 1.1 billion fish lost in water intakes)	0% No change in status quo	5% <0.1 billion fish saved	5% <0.1 billion fish saved
 **Condition of Aquatic Ecosystems** (in 3-5 Years)	50% (100% is pristine condition)	52% (100% is pristine condition)	54% (100% is pristine condition)
$ **Increase in Cost of Living for Your Household**	$0 No cost increase	$48 **per year** ($4 per month)	$48 **per year** ($4 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I would vote for **NO POLICY**	☐ I would vote for **OPTION A**	☐ I would vote for **OPTION B**

POLICIES COULD REQUIRE DIFFERENT COMBINATIONS OF TECHNOLOGY

Now you will be asked to consider a new set of policy options for Northeast waters. As you vote, please remember—

- Questions 5 and 6 present new sets of policy options. These options require a different mix of technologies in different areas.
- Each question is a separate vote. Questions 5 and 6 cannot be directly compared to each other, or to Question 4.
- Do not add up effects or costs across different questions.
- Policy costs and effects depend on many factors. Saving more fish does not necessarily mean that all effects will improve.

12

Question 5. Assume that Options A and B would require a different mix of filters and closed cycle cooling in different areas. Assume all types of fish are affected. How would you vote?

Policy Effect NE Waters	Current Situation (No policy)	Option A	Option B
 **Commercial Fish Populations** (in 3-5 Years)	42% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)
 **Fish Populations (all fish)** (in 3-5 Years)	26% (100% is populations without human influence)	28% (100% is populations without human influence)	30% (100% is populations without human influence)
 **Fish Saved per Year** (Out of 1.1 billion fish lost in water intakes)	0% No change in status quo	50% 0.6 billion fish saved	95% 1.0 billion fish saved
 **Condition of Aquatic Ecosystems** (in 3-5 Years)	50% (100% is pristine condition)	51% (100% is pristine condition)	52% (100% is pristine condition)
$ **Increase in Cost of Living for Your Household**	$0 No cost increase	$60 **per year** ($5 per month)	$72 **per year** ($6 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I would vote for **NO POLICY**	☐ I would vote for **OPTION A**	☐ I would vote for **OPTION B**

Question 6. Assume that Options A and B would require a different mix of filters and closed cycle cooling in different areas. Assume all types of fish are affected. How would you vote?

Policy Effect NE Waters	Current Situation (No policy)	Option A	Option B
 Commercial Fish Populations (in 3-5 Years)	42% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)	45% (100% is populations that allow for maximum harvest)
 Fish Populations (all fish) (in 3-5 Years)	26% (100% is populations without human influence)	27% (100% is populations without human influence)	27% (100% is populations without human influence)
 Fish Saved per Year (Out of 1.1 billion fish lost in water intakes)	0% No change in status quo	50% 0.6 billion fish saved	50% 0.6 billion fish saved
 Condition of Aquatic Ecosystems (in 3-5 Years)	50% (100% is pristine condition)	52% (100% is pristine condition)	51% (100% is pristine condition)
$ Increase in Cost of Living for Your Household	$0 No cost increase	$72 **per year** ($6 per month)	$12 **per year** ($1 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I would vote for **NO POLICY**	☐ I would vote for **OPTION A**	☐ I would vote for **OPTION B**

Question 7. If you **always voted for NO POLICY** in questions 4-6, what was the primary reason? Check one. (Skip this question if you voted for Option A or B in any question above.)

____ The cost to my household was too high

____ Preventing fish losses is not important to me

____ I do not trust the government to fix the problem

____ I would rather spend my money on other things

____ I did not believe the choices were realistic

____ Since the problem was created by private facilities, they should fix it without passing costs on to consumers

Question 8. Indicate how strongly you agree with the following statements about questions 4 - 6 and the information provided. Check one box for each.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	←				→
The survey provided enough information for me to make informed choices	☐1	☐2	☐3	☐4	☐5
I feel confident about my answers	☐1	☐2	☐3	☐4	☐5
Information in the survey was easy for me to understand	☐1	☐2	☐3	☐4	☐5
Information in the survey was fair and unbiased	☐1	☐2	☐3	☐4	☐5
Questions were easy for me to answer	☐1	☐2	☐3	☐4	☐5
I would vote the same way in an actual public vote	☐1	☐2	☐3	☐4	☐5
The effect of the proposed policies depends on many factors	☐1	☐2	☐3	☐4	☐5
Future ecological conditions are never 100% guaranteed	☐1	☐2	☐3	☐4	☐5

Question 9. How much did the following factors affect your answers to questions 4 – 6? Check one box for each row.

	Effect on my answers to questions 4-6				
	Very Small Effect		Moderate Effect		Very Large Effect
Wanting to reduce taxes or costs to my household.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to prevent the loss of industrial jobs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to preserve fish for commercial fishing.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to send a message that all environmental issues are important regardless of cost.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to preserve fish for recreation (fishing, etc.).	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to preserve fish to benefit aquatic ecosystems.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to know that fish exist in local lakes, rivers and bays.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to pay my fair share for government programs.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to sustain the competitiveness of US business	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to preserve fish as a source of food for people.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wanting to preserve fish and ecosystems for future generations.	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

16

Question 10. How many days did you participate in the following during the last year? For trips longer than one day, please count each day separately. Check one box for each row.

	Number of days you did the activity during the past year				
	0	1-5	6-10	11-15	16+
Boating / Canoeing / Kayaking	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Swimming / Going to the Beach	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Recreational Fishing (Fresh Water)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Recreational Fishing (Salt Water)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Shellfishing / Crabbing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Scuba Diving / Snorkeling	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Question 11. Do you consume commercially caught fish or seafood? ❑ Yes ❑ No

Do you consume recreationally caught fish or seafood? ❑ Yes ❑ No

17

The following questions ensure that all groups are fairly represented. All answers kept confidential to the extent provided by law.

12. What is your age?___ years

13. What is your gender? ❑ Male ❑ Female

14. What is the highest level of education that you have completed?

- ❑ Less than high school
- ❑ High school or equivalent
- ❑ High school + technical school
- ❑ One or more years of college
- ❑ Bachelor's Degree
- ❑ Graduate Degree

15. How many people live in your household? _____

16. How many of these people are 16 years of age or older? ____

17. How many of these people are 6 years of age or younger? ____

18. What is your zip code?_____

19. Are you currently employed? ❑ Yes ❑ No

20. Are you currently employed in the commercial fish industry? ❑ Yes ❑ No

21. Are you of Hispanic or Latino origin? ❑ Yes ❑ No

22. Which of the following racial categories describes you? You may select more than one.

- ❑ American Indian or Alaskan Native
- ❑ Asian
- ❑ Black or African American
- ❑ White
- ❑ Native Hawaiian or Other Pacific Islander

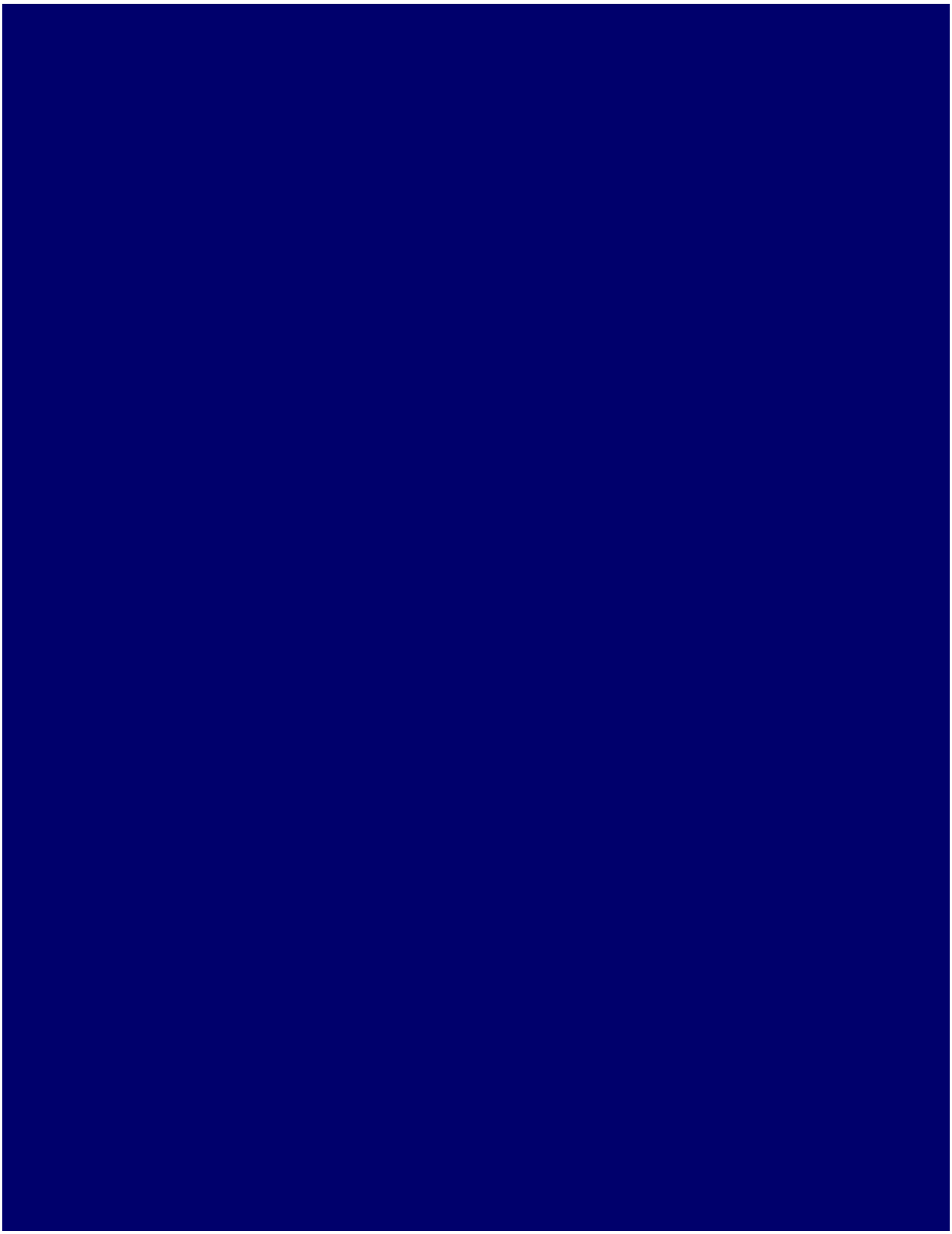
23. What category comes closest to your total household income?

- ☐ Less than $10,000
- ☐ $10,000 to $19,999
- ☐ $20,000 to $39,999
- ☐ $40,000 to $59,999
- ☐ $60,000 to $79,999
- ☐ $80,000 to $99,999
- ☐ $100,000 to $249,999
- ☐ $250,000 or more

24. If you have any comments on this survey, please write them below:

Thank you for your participation in this important survey!

18



Appendix B: Experimental Design for the Regional and National Surveys

Table B-1—Experimental Design for the Northeast Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish	Fish Pop.	Fish Saved	Aq. Cond.	Cost	Com. Fish	Fish Pop.	Fish Saved	Aq. Cond.	Cost
1	1	4	45%	30%	5%	52%	$48	48%	27%	5%	54%	$48
1	2	5	48%	28%	50%	51%	$60	48%	30%	95%	52%	$72
1	3	6	48%	27%	50%	52%	$72	45%	27%	50%	51%	$12
2	1	4	48%	30%	5%	52%	$48	43%	28%	50%	52%	$12
2	2	5	45%	28%	50%	54%	$24	48%	27%	50%	51%	$36
2	3	6	43%	27%	5%	54%	$36	45%	27%	95%	51%	$24
3	1	4	48%	30%	5%	51%	$48	48%	27%	5%	54%	$72
3	2	5	45%	28%	95%	54%	$60	45%	28%	95%	52%	$12
3	3	6	43%	28%	5%	54%	$12	43%	30%	50%	54%	$24
4	1	4	45%	28%	95%	54%	$72	43%	30%	5%	51%	$72
4	2	5	48%	30%	95%	52%	$36	45%	28%	50%	54%	$36
4	3	6	45%	27%	50%	51%	$60	43%	27%	95%	52%	$48
5	1	4	48%	27%	50%	52%	$24	45%	30%	50%	54%	$48
5	2	5	45%	27%	5%	51%	$36	43%	28%	5%	51%	$36
5	3	6	43%	30%	50%	54%	$12	45%	28%	5%	51%	$60
6	1	4	43%	28%	95%	52%	$36	43%	30%	5%	54%	$72
6	2	5	48%	27%	95%	54%	$60	48%	28%	95%	52%	$36
6	3	6	43%	28%	50%	51%	$48	45%	27%	50%	51%	$24
7	1	4	43%	30%	50%	54%	$48	43%	30%	95%	51%	$12
7	2	5	48%	28%	95%	51%	$24	45%	27%	5%	54%	$60
7	3	6	45%	27%	5%	51%	$36	48%	28%	50%	52%	$72
8	1	4	45%	30%	5%	51%	$36	45%	30%	95%	54%	$72
8	2	5	43%	28%	95%	51%	$60	48%	28%	50%	51%	$72
8	3	6	45%	28%	50%	52%	$60	43%	28%	5%	52%	$24
9	1	4	48%	27%	5%	54%	$72	48%	28%	50%	51%	$48
9	2	5	43%	30%	50%	51%	$24	45%	30%	95%	52%	$72
9	3	6	43%	28%	95%	52%	$12	43%	27%	95%	54%	$48
10	1	4	48%	30%	50%	51%	$60	43%	30%	50%	51%	$24
10	2	5	45%	28%	95%	54%	$48	45%	30%	95%	52%	$48
10	3	6	43%	28%	50%	52%	$36	48%	28%	95%	54%	$72
11	1	4	45%	28%	5%	51%	$12	48%	30%	95%	52%	$60
11	2	5	48%	30%	95%	54%	$60	43%	27%	5%	54%	$24
11	3	6	43%	30%	50%	52%	$36	45%	28%	5%	51%	$12
12	1	4	48%	28%	95%	51%	$36	48%	30%	50%	51%	$48
12	2	5	43%	27%	5%	54%	$60	45%	27%	95%	52%	$60
12	3	6	43%	30%	50%	52%	$72	43%	27%	50%	54%	$72

Table B-1—Experimental Design for the Northeast Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish	Fish Pop.	Fish Saved	Aq. Cond.	Cost	Com. Fish	Fish Pop.	Fish Saved	Aq. Cond.	Cost
13	1	4	48%	27%	95%	54%	$24	48%	30%	5%	52%	$24
13	2	5	45%	27%	50%	51%	$12	43%	28%	95%	54%	$48
13	3	6	43%	30%	5%	52%	$60	45%	30%	5%	51%	$60
14	1	4	45%	30%	50%	54%	$36	48%	28%	95%	54%	$24
14	2	5	48%	28%	5%	52%	$60	45%	27%	95%	52%	$72
14	3	6	48%	27%	95%	51%	$48	43%	30%	50%	51%	$60
15	1	4	43%	27%	5%	54%	$36	45%	30%	50%	52%	$12
15	2	5	45%	27%	50%	52%	$48	48%	27%	5%	52%	$24
15	3	6	45%	30%	95%	51%	$72	43%	28%	50%	54%	$60
16	1	4	43%	28%	5%	54%	$48	48%	28%	50%	54%	$60
16	2	5	48%	30%	50%	54%	$48	45%	28%	5%	51%	$36
16	3	6	45%	27%	5%	52%	$72	43%	30%	95%	51%	$24
17	1	4	45%	27%	95%	54%	$48	45%	28%	95%	51%	$72
17	2	5	45%	27%	95%	52%	$24	45%	30%	50%	54%	$12
17	3	6	48%	28%	5%	54%	$12	48%	27%	50%	52%	$60
18	1	4	43%	27%	95%	52%	$48	43%	28%	5%	52%	$36
18	2	5	45%	27%	50%	54%	$12	48%	30%	5%	54%	$72
18	3	6	43%	30%	5%	51%	$24	48%	27%	95%	51%	$12
19	1	4	43%	30%	95%	51%	$12	48%	30%	5%	52%	$36
19	2	5	45%	27%	95%	52%	$60	43%	27%	95%	51%	$36
19	3	6	48%	28%	5%	52%	$72	45%	28%	5%	52%	$24
20	1	4	43%	30%	5%	52%	$60	48%	30%	5%	51%	$48
20	2	5	45%	30%	95%	51%	$12	45%	28%	50%	52%	$24
20	3	6	48%	28%	50%	54%	$36	43%	27%	5%	52%	$12
21	1	4	48%	27%	95%	51%	$72	48%	27%	5%	54%	$12
21	2	5	45%	30%	5%	54%	$24	43%	27%	50%	52%	$36
21	3	6	43%	28%	95%	52%	$24	48%	28%	95%	51%	$24
22	1	4	43%	27%	50%	51%	$60	43%	28%	5%	54%	$12
22	2	5	43%	30%	95%	54%	$72	45%	27%	50%	52%	$48
22	3	6	48%	27%	5%	52%	$12	43%	30%	95%	51%	$36
23	1	4	43%	27%	5%	51%	$24	43%	28%	5%	52%	$48
23	2	5	48%	27%	95%	52%	$12	48%	30%	95%	51%	$12
23	3	6	48%	28%	50%	51%	$48	45%	30%	95%	54%	$36
24	1	4	45%	28%	50%	52%	$12	48%	30%	50%	54%	$60
24	2	5	43%	27%	50%	54%	$72	45%	27%	5%	51%	$36
24	3	6	48%	30%	5%	54%	$24	43%	28%	95%	54%	$72

"Com. Fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table B-2—Experimental Design for the Southeast Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	4	42%	28%	25%	70%	$48	45%	25%	25%	72%	$48
1	2	5	45%	26%	55%	69%	$60	45%	28%	90%	70%	$72
1	3	6	45%	25%	55%	70%	$72	42%	25%	55%	69%	$12
2	1	4	45%	28%	25%	70%	$48	40%	26%	55%	70%	$12
2	2	5	42%	26%	55%	72%	$24	45%	25%	55%	69%	$36
2	3	6	40%	25%	25%	72%	$36	42%	25%	90%	69%	$24
3	1	4	45%	28%	25%	69%	$48	45%	25%	25%	72%	$72
3	2	5	42%	26%	90%	72%	$60	42%	26%	90%	70%	$12
3	3	6	40%	26%	25%	72%	$12	40%	28%	55%	72%	$24
4	1	4	42%	26%	90%	72%	$72	40%	28%	25%	69%	$72
4	2	5	45%	28%	90%	70%	$36	42%	26%	55%	72%	$36
4	3	6	42%	25%	55%	69%	$60	40%	25%	90%	70%	$48
5	1	4	45%	25%	55%	70%	$24	42%	28%	55%	72%	$48
5	2	5	42%	25%	25%	69%	$36	40%	26%	25%	69%	$36
5	3	6	40%	28%	55%	72%	$12	42%	26%	25%	69%	$60
6	1	4	40%	26%	90%	70%	$36	40%	28%	25%	72%	$72
6	2	5	45%	25%	90%	72%	$60	45%	26%	90%	70%	$36
6	3	6	40%	26%	55%	69%	$48	42%	25%	55%	69%	$24
7	1	4	40%	28%	55%	72%	$48	40%	28%	90%	69%	$12
7	2	5	45%	26%	90%	69%	$24	42%	25%	25%	72%	$60
7	3	6	42%	25%	25%	69%	$36	45%	26%	55%	70%	$72
8	1	4	42%	28%	25%	69%	$36	42%	28%	90%	72%	$72
8	2	5	40%	26%	90%	69%	$60	45%	26%	55%	69%	$72
8	3	6	42%	26%	55%	70%	$60	40%	26%	25%	70%	$24
9	1	4	45%	25%	25%	72%	$72	45%	26%	55%	69%	$48
9	2	5	40%	28%	55%	69%	$24	42%	28%	90%	70%	$72
9	3	6	40%	26%	90%	70%	$12	40%	25%	90%	72%	$48
10	1	4	45%	28%	55%	69%	$60	40%	28%	55%	69%	$24
10	2	5	42%	26%	90%	72%	$48	42%	28%	90%	70%	$48
10	3	6	40%	26%	55%	70%	$36	45%	26%	90%	72%	$72
11	1	4	42%	26%	25%	69%	$12	45%	28%	90%	70%	$60
11	2	5	45%	28%	90%	72%	$60	40%	25%	25%	72%	$24
11	3	6	40%	28%	55%	70%	$36	42%	26%	25%	69%	$12
12	1	4	45%	26%	90%	69%	$36	45%	28%	55%	69%	$48
12	2	5	40%	25%	25%	72%	$60	42%	25%	90%	70%	$60
12	3	6	40%	28%	55%	70%	$72	40%	25%	55%	72%	$72
13	1	4	45%	25%	90%	72%	$24	45%	28%	25%	70%	$24
13	2	5	42%	25%	55%	69%	$12	40%	26%	90%	72%	$48
13	3	6	40%	28%	25%	70%	$60	42%	28%	25%	69%	$60
14	1	4	42%	28%	55%	72%	$36	45%	26%	90%	72%	$24
14	2	5	45%	26%	25%	70%	$60	42%	25%	90%	70%	$72

Table B-2—Experimental Design for the Southeast Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	6	45%	25%	90%	69%	$48	40%	28%	55%	69%	$60
15	1	4	40%	25%	25%	72%	$36	42%	28%	55%	70%	$12
15	2	5	42%	25%	55%	70%	$48	45%	25%	25%	70%	$24
15	3	6	42%	28%	90%	69%	$72	40%	26%	55%	72%	$60
16	1	4	40%	26%	25%	72%	$48	45%	26%	55%	72%	$60
16	2	5	45%	28%	55%	72%	$48	42%	26%	25%	69%	$36
16	3	6	42%	25%	25%	70%	$72	40%	28%	90%	69%	$24
17	1	4	42%	25%	90%	72%	$48	42%	26%	90%	69%	$72
17	2	5	42%	25%	90%	70%	$24	42%	28%	55%	72%	$12
17	3	6	45%	26%	25%	72%	$12	45%	25%	55%	70%	$60
18	1	4	40%	25%	90%	70%	$48	40%	26%	25%	70%	$36
18	2	5	42%	25%	55%	72%	$12	45%	28%	25%	72%	$72
18	3	6	40%	28%	25%	69%	$24	45%	25%	90%	69%	$12
19	1	4	40%	28%	90%	69%	$12	45%	28%	25%	70%	$36
19	2	5	42%	25%	90%	70%	$60	40%	25%	90%	69%	$36
19	3	6	45%	26%	25%	70%	$72	42%	26%	25%	70%	$24
20	1	4	40%	28%	25%	70%	$60	45%	28%	25%	69%	$48
20	2	5	42%	28%	90%	69%	$12	42%	26%	55%	70%	$24
20	3	6	45%	26%	55%	72%	$36	40%	25%	25%	70%	$12
21	1	4	45%	25%	90%	69%	$72	45%	25%	25%	72%	$12
21	2	5	42%	28%	25%	72%	$24	40%	25%	55%	70%	$36
21	3	6	40%	26%	90%	70%	$24	45%	26%	90%	69%	$24
22	1	4	40%	25%	55%	69%	$60	40%	26%	25%	72%	$12
22	2	5	40%	28%	90%	72%	$72	42%	25%	55%	70%	$48
22	3	6	45%	25%	25%	70%	$12	40%	28%	90%	69%	$36
23	1	4	40%	25%	25%	69%	$24	40%	26%	25%	70%	$48
23	2	5	45%	25%	90%	70%	$12	45%	28%	90%	69%	$12
23	3	6	45%	26%	55%	69%	$48	42%	28%	90%	72%	$36
24	1	4	42%	26%	55%	70%	$12	45%	28%	55%	72%	$60
24	2	5	40%	25%	55%	72%	$72	42%	25%	25%	69%	$36
24	3	6	45%	28%	25%	72%	$24	40%	26%	90%	72%	$72

"Com. Fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table B-3—Experimental Design for the Pacific Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	4	59%	36%	2%	53%	$48	62%	33%	2%	55%	$48
1	2	5	62%	34%	50%	52%	$60	62%	36%	95%	53%	$72
1	3	6	62%	33%	50%	53%	$72	59%	33%	50%	52%	$12
2	1	4	62%	36%	2%	53%	$48	57%	34%	50%	53%	$12
2	2	5	59%	34%	50%	55%	$24	62%	33%	50%	52%	$36
2	3	6	57%	33%	2%	55%	$36	59%	33%	95%	52%	$24
3	1	4	62%	36%	2%	52%	$48	62%	33%	2%	55%	$72
3	2	5	59%	34%	95%	55%	$60	59%	34%	95%	53%	$12
3	3	6	57%	34%	2%	55%	$12	57%	36%	50%	55%	$24
4	1	4	59%	34%	95%	55%	$72	57%	36%	2%	52%	$72
4	2	5	62%	36%	95%	53%	$36	59%	34%	50%	55%	$36
4	3	6	59%	33%	50%	52%	$60	57%	33%	95%	53%	$48
5	1	4	62%	33%	50%	53%	$24	59%	36%	50%	55%	$48
5	2	5	59%	33%	2%	52%	$36	57%	34%	2%	52%	$36
5	3	6	57%	36%	50%	55%	$12	59%	34%	2%	52%	$60
6	1	4	57%	34%	95%	53%	$36	57%	36%	2%	55%	$72
6	2	5	62%	33%	95%	55%	$60	62%	34%	95%	53%	$36
6	3	6	57%	34%	50%	52%	$48	59%	33%	50%	52%	$24
7	1	4	57%	36%	50%	55%	$48	57%	36%	95%	52%	$12
7	2	5	62%	34%	95%	52%	$24	59%	33%	2%	55%	$60
7	3	6	59%	33%	2%	52%	$36	62%	34%	50%	53%	$72
8	1	4	59%	36%	2%	52%	$36	59%	36%	95%	55%	$72
8	2	5	57%	34%	95%	52%	$60	62%	34%	50%	52%	$72
8	3	6	59%	34%	50%	53%	$60	57%	34%	2%	53%	$24
9	1	4	62%	33%	2%	55%	$72	62%	34%	50%	52%	$48
9	2	5	57%	36%	50%	52%	$24	59%	36%	95%	53%	$72
9	3	6	57%	34%	95%	53%	$12	57%	33%	95%	55%	$48
10	1	4	62%	36%	50%	52%	$60	57%	36%	50%	52%	$24
10	2	5	59%	34%	95%	55%	$48	59%	36%	95%	53%	$48
10	3	6	57%	34%	50%	53%	$36	62%	34%	95%	55%	$72
11	1	4	59%	34%	2%	52%	$12	62%	36%	95%	53%	$60
11	2	5	62%	36%	95%	55%	$60	57%	33%	2%	55%	$24
11	3	6	57%	36%	50%	53%	$36	59%	34%	2%	52%	$12
12	1	4	62%	34%	95%	52%	$36	62%	36%	50%	52%	$48
12	2	5	57%	33%	2%	55%	$60	59%	33%	95%	53%	$60
12	3	6	57%	36%	50%	53%	$72	57%	33%	50%	55%	$72
13	1	4	62%	33%	95%	55%	$24	62%	36%	2%	53%	$24
13	2	5	59%	33%	50%	52%	$12	57%	34%	95%	55%	$48
13	3	6	57%	36%	2%	53%	$60	59%	36%	2%	52%	$60
14	1	4	59%	36%	50%	55%	$36	62%	34%	95%	55%	$24
14	2	5	62%	34%	2%	53%	$60	59%	33%	95%	53%	$72

Table B-3—Experimental Design for the Pacific Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	6	62%	33%	95%	52%	$48	57%	36%	50%	52%	$60
15	1	4	57%	33%	2%	55%	$36	59%	36%	50%	53%	$12
15	2	5	59%	33%	50%	53%	$48	62%	33%	2%	53%	$24
15	3	6	59%	36%	95%	52%	$72	57%	34%	50%	55%	$60
16	1	4	57%	34%	2%	55%	$48	62%	34%	50%	55%	$60
16	2	5	62%	36%	50%	55%	$48	59%	34%	2%	52%	$36
16	3	6	59%	33%	2%	53%	$72	57%	36%	95%	52%	$24
17	1	4	59%	33%	95%	55%	$48	59%	34%	95%	52%	$72
17	2	5	59%	33%	95%	53%	$24	59%	36%	50%	55%	$12
17	3	6	62%	34%	2%	55%	$12	62%	33%	50%	53%	$60
18	1	4	57%	33%	95%	53%	$48	57%	34%	2%	53%	$36
18	2	5	59%	33%	50%	55%	$12	62%	36%	2%	55%	$72
18	3	6	57%	36%	2%	52%	$24	62%	33%	95%	52%	$12
19	1	4	57%	36%	95%	52%	$12	62%	36%	2%	53%	$36
19	2	5	59%	33%	95%	53%	$60	57%	33%	95%	52%	$36
19	3	6	62%	34%	2%	53%	$72	59%	34%	2%	53%	$24
20	1	4	57%	36%	2%	53%	$60	62%	36%	2%	52%	$48
20	2	5	59%	36%	95%	52%	$12	59%	34%	50%	53%	$24
20	3	6	62%	34%	50%	55%	$36	57%	33%	2%	53%	$12
21	1	4	62%	33%	95%	52%	$72	62%	33%	2%	55%	$12
21	2	5	59%	36%	2%	55%	$24	57%	33%	50%	53%	$36
21	3	6	57%	34%	95%	53%	$24	62%	34%	95%	52%	$24
22	1	4	57%	33%	50%	52%	$60	57%	34%	2%	55%	$12
22	2	5	57%	36%	95%	55%	$72	59%	33%	50%	53%	$48
22	3	6	62%	33%	2%	53%	$12	57%	36%	95%	52%	$36
23	1	4	57%	33%	2%	52%	$24	57%	34%	2%	53%	$48
23	2	5	62%	33%	95%	53%	$12	62%	36%	95%	52%	$12
23	3	6	62%	34%	50%	52%	$48	59%	36%	95%	55%	$36
24	1	4	59%	34%	50%	53%	$12	62%	36%	50%	55%	$60
24	2	5	57%	33%	50%	55%	$72	59%	33%	2%	52%	$36
24	3	6	62%	36%	2%	55%	$24	57%	34%	95%	55%	$72

"Com. Fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table B-4—Experimental Design for the Inland Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	4	42%	37%	55%	44%	$48	45%	34%	55%	46%	$48
1	2	5	45%	35%	75%	43%	$60	45%	37%	95%	44%	$72
1	3	6	45%	34%	75%	44%	$72	42%	34%	75%	43%	$12
2	1	4	45%	37%	55%	44%	$48	40%	35%	75%	44%	$12
2	2	5	42%	35%	75%	46%	$24	45%	34%	75%	43%	$36
2	3	6	40%	34%	55%	46%	$36	42%	34%	95%	43%	$24
3	1	4	45%	37%	55%	43%	$48	45%	34%	55%	46%	$72
3	2	5	42%	35%	95%	46%	$60	42%	35%	95%	44%	$12
3	3	6	40%	35%	55%	46%	$12	40%	37%	75%	46%	$24
4	1	4	42%	35%	95%	46%	$72	40%	37%	55%	43%	$72
4	2	5	45%	37%	95%	44%	$36	42%	35%	75%	46%	$36
4	3	6	42%	34%	75%	43%	$60	40%	34%	95%	44%	$48
5	1	4	45%	34%	75%	44%	$24	42%	37%	75%	46%	$48
5	2	5	42%	34%	55%	43%	$36	40%	35%	55%	43%	$36
5	3	6	40%	37%	75%	46%	$12	42%	35%	55%	43%	$60
6	1	4	40%	35%	95%	44%	$36	40%	37%	55%	46%	$72
6	2	5	45%	34%	95%	46%	$60	45%	35%	95%	44%	$36
6	3	6	40%	35%	75%	43%	$48	42%	34%	75%	43%	$24
7	1	4	40%	37%	75%	46%	$48	40%	37%	95%	43%	$12
7	2	5	45%	35%	95%	43%	$24	42%	34%	55%	46%	$60
7	3	6	42%	34%	55%	43%	$36	45%	35%	75%	44%	$72
8	1	4	42%	37%	55%	43%	$36	42%	37%	95%	46%	$72
8	2	5	40%	35%	95%	43%	$60	45%	35%	75%	43%	$72
8	3	6	42%	35%	75%	44%	$60	40%	35%	55%	44%	$24
9	1	4	45%	34%	55%	46%	$72	45%	35%	75%	43%	$48
9	2	5	40%	37%	75%	43%	$24	42%	37%	95%	44%	$72
9	3	6	40%	35%	95%	44%	$12	40%	34%	95%	46%	$48
10	1	4	45%	37%	75%	43%	$60	40%	37%	75%	43%	$24
10	2	5	42%	35%	95%	46%	$48	42%	37%	95%	44%	$48
10	3	6	40%	35%	75%	44%	$36	45%	35%	95%	46%	$72
11	1	4	42%	35%	55%	43%	$12	45%	37%	95%	44%	$60
11	2	5	45%	37%	95%	46%	$60	40%	34%	55%	46%	$24
11	3	6	40%	37%	75%	44%	$36	42%	35%	55%	43%	$12
12	1	4	45%	35%	95%	43%	$36	45%	37%	75%	43%	$48
12	2	5	40%	34%	55%	46%	$60	42%	34%	95%	44%	$60
12	3	6	40%	37%	75%	44%	$72	40%	34%	75%	46%	$72
13	1	4	45%	34%	95%	46%	$24	45%	37%	55%	44%	$24
13	2	5	42%	34%	75%	43%	$12	40%	35%	95%	46%	$48
13	3	6	40%	37%	55%	44%	$60	42%	37%	55%	43%	$60
14	1	4	42%	37%	75%	46%	$36	45%	35%	95%	46%	$24
14	2	5	45%	35%	55%	44%	$60	42%	34%	95%	44%	$72

Table B-4—Experimental Design for the Inland Survey Region

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	6	45%	34%	95%	43%	$48	40%	37%	75%	43%	$60
15	1	4	40%	34%	55%	46%	$36	42%	37%	75%	44%	$12
15	2	5	42%	34%	75%	44%	$48	45%	34%	55%	44%	$24
15	3	6	42%	37%	95%	43%	$72	40%	35%	75%	46%	$60
16	1	4	40%	35%	55%	46%	$48	45%	35%	75%	46%	$60
16	2	5	45%	37%	75%	46%	$48	42%	35%	55%	43%	$36
16	3	6	42%	34%	55%	44%	$72	40%	37%	95%	43%	$24
17	1	4	42%	34%	95%	46%	$48	42%	35%	95%	43%	$72
17	2	5	42%	34%	95%	44%	$24	42%	37%	75%	46%	$12
17	3	6	45%	35%	55%	46%	$12	45%	34%	75%	44%	$60
18	1	4	40%	34%	95%	44%	$48	40%	35%	55%	44%	$36
18	2	5	42%	34%	75%	46%	$12	45%	37%	55%	46%	$72
18	3	6	40%	37%	55%	43%	$24	45%	34%	95%	43%	$12
19	1	4	40%	37%	95%	43%	$12	45%	37%	55%	44%	$36
19	2	5	42%	34%	95%	44%	$60	40%	34%	95%	43%	$36
19	3	6	45%	35%	55%	44%	$72	42%	35%	55%	44%	$24
20	1	4	40%	37%	55%	44%	$60	45%	37%	55%	43%	$48
20	2	5	42%	37%	95%	43%	$12	42%	35%	75%	44%	$24
20	3	6	45%	35%	75%	46%	$36	40%	34%	55%	44%	$12
21	1	4	45%	34%	95%	43%	$72	45%	34%	55%	46%	$12
21	2	5	42%	37%	55%	46%	$24	40%	34%	75%	44%	$36
21	3	6	40%	35%	95%	44%	$24	45%	35%	95%	43%	$24
22	1	4	40%	34%	75%	43%	$60	40%	35%	55%	46%	$12
22	2	5	40%	37%	95%	46%	$72	42%	34%	75%	44%	$48
22	3	6	45%	34%	55%	44%	$12	40%	37%	95%	43%	$36
23	1	4	40%	34%	55%	43%	$24	40%	35%	55%	44%	$48
23	2	5	45%	34%	95%	44%	$12	45%	37%	95%	43%	$12
23	3	6	45%	35%	75%	43%	$48	42%	37%	95%	46%	$36
24	1	4	42%	35%	75%	44%	$12	45%	37%	75%	46%	$60
24	2	5	40%	34%	75%	46%	$72	42%	34%	55%	43%	$36
24	3	6	45%	37%	55%	46%	$24	40%	35%	95%	46%	$72

"Com. Fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table B-5—Experimental Design for the National Survey

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	4	54%	34%	25%	55%	$48	57%	31%	25%	57%	$48
1	2	5	57%	32%	55%	54%	$60	57%	34%	95%	55%	$72
1	3	6	57%	31%	55%	55%	$72	54%	31%	55%	54%	$12
2	1	4	57%	34%	25%	55%	$48	52%	32%	55%	55%	$12
2	2	5	54%	32%	55%	57%	$24	57%	31%	55%	54%	$36
2	3	6	52%	31%	25%	57%	$36	54%	31%	95%	54%	$24
3	1	4	57%	34%	25%	54%	$48	57%	31%	25%	57%	$72
3	2	5	54%	32%	95%	57%	$60	54%	32%	95%	55%	$12
3	3	6	52%	32%	25%	57%	$12	52%	34%	55%	57%	$24
4	1	4	54%	32%	95%	57%	$72	52%	34%	25%	54%	$72
4	2	5	57%	34%	95%	55%	$36	54%	32%	55%	57%	$36
4	3	6	54%	31%	55%	54%	$60	52%	31%	95%	55%	$48
5	1	4	57%	31%	55%	55%	$24	54%	34%	55%	57%	$48
5	2	5	54%	31%	25%	54%	$36	52%	32%	25%	54%	$36
5	3	6	52%	34%	55%	57%	$12	54%	32%	25%	54%	$60
6	1	4	52%	32%	95%	55%	$36	52%	34%	25%	57%	$72
6	2	5	57%	31%	95%	57%	$60	57%	32%	95%	55%	$36
6	3	6	52%	32%	55%	54%	$48	54%	31%	55%	54%	$24
7	1	4	52%	34%	55%	57%	$48	52%	34%	95%	54%	$12
7	2	5	57%	32%	95%	54%	$24	54%	31%	25%	57%	$60
7	3	6	54%	31%	25%	54%	$36	57%	32%	55%	55%	$72
8	1	4	54%	34%	25%	54%	$36	54%	34%	95%	57%	$72
8	2	5	52%	32%	95%	54%	$60	57%	32%	55%	54%	$72
8	3	6	54%	32%	55%	55%	$60	52%	32%	25%	55%	$24
9	1	4	57%	31%	25%	57%	$72	57%	32%	55%	54%	$48
9	2	5	52%	34%	55%	54%	$24	54%	34%	95%	55%	$72
9	3	6	52%	32%	95%	55%	$12	52%	31%	95%	57%	$48
10	1	4	57%	34%	55%	54%	$60	52%	34%	55%	54%	$24
10	2	5	54%	32%	95%	57%	$48	54%	34%	95%	55%	$48
10	3	6	52%	32%	55%	55%	$36	57%	32%	95%	57%	$72
11	1	4	54%	32%	25%	54%	$12	57%	34%	95%	55%	$60
11	2	5	57%	34%	95%	57%	$60	52%	31%	25%	57%	$24
11	3	6	52%	34%	55%	55%	$36	54%	32%	25%	54%	$12
12	1	4	57%	32%	95%	54%	$36	57%	34%	55%	54%	$48
12	2	5	52%	31%	25%	57%	$60	54%	31%	95%	55%	$60
12	3	6	52%	34%	55%	55%	$72	52%	31%	55%	57%	$72
13	1	4	57%	31%	95%	57%	$24	57%	34%	25%	55%	$24
13	2	5	54%	31%	55%	54%	$12	52%	32%	95%	57%	$48
13	3	6	52%	34%	25%	55%	$60	54%	34%	25%	54%	$60
14	1	4	54%	34%	55%	57%	$36	57%	32%	95%	57%	$24
14	2	5	57%	32%	25%	55%	$60	54%	31%	95%	55%	$72

Table B-5—Experimental Design for the National Survey

Survey Version	Choice Question	Survey Question	Option A					Option B				
			Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	6	57%	31%	95%	54%	$48	52%	34%	55%	54%	$60
15	1	4	52%	31%	25%	57%	$36	54%	34%	55%	55%	$12
15	2	5	54%	31%	55%	55%	$48	57%	31%	25%	55%	$24
15	3	6	54%	34%	95%	54%	$72	52%	32%	55%	57%	$60
16	1	4	52%	32%	25%	57%	$48	57%	32%	55%	57%	$60
16	2	5	57%	34%	55%	57%	$48	54%	32%	25%	54%	$36
16	3	6	54%	31%	25%	55%	$72	52%	34%	95%	54%	$24
17	1	4	54%	31%	95%	57%	$48	54%	32%	95%	54%	$72
17	2	5	54%	31%	95%	55%	$24	54%	34%	55%	57%	$12
17	3	6	57%	32%	25%	57%	$12	57%	31%	55%	55%	$60
18	1	4	52%	31%	95%	55%	$48	52%	32%	25%	55%	$36
18	2	5	54%	31%	55%	57%	$12	57%	34%	25%	57%	$72
18	3	6	52%	34%	25%	54%	$24	57%	31%	95%	54%	$12
19	1	4	52%	34%	95%	54%	$12	57%	34%	25%	55%	$36
19	2	5	54%	31%	95%	55%	$60	52%	31%	95%	54%	$36
19	3	6	57%	32%	25%	55%	$72	54%	32%	25%	55%	$24
20	1	4	52%	34%	25%	55%	$60	57%	34%	25%	54%	$48
20	2	5	54%	34%	95%	54%	$12	54%	32%	55%	55%	$24
20	3	6	57%	32%	55%	57%	$36	52%	31%	25%	55%	$12
21	1	4	57%	31%	95%	54%	$72	57%	31%	25%	57%	$12
21	2	5	54%	34%	25%	57%	$24	52%	31%	55%	55%	$36
21	3	6	52%	32%	95%	55%	$24	57%	32%	95%	54%	$24
22	1	4	52%	31%	55%	54%	$60	52%	32%	25%	57%	$12
22	2	5	52%	34%	95%	57%	$72	54%	31%	55%	55%	$48
22	3	6	57%	31%	25%	55%	$12	52%	34%	95%	54%	$36
23	1	4	52%	31%	25%	54%	$24	52%	32%	25%	55%	$48
23	2	5	57%	31%	95%	55%	$12	57%	34%	95%	54%	$12
23	3	6	57%	32%	55%	54%	$48	54%	34%	95%	57%	$36
24	1	4	54%	32%	55%	55%	$12	57%	34%	55%	57%	$60
24	2	5	52%	31%	55%	57%	$72	54%	31%	25%	54%	$36
24	3	6	57%	34%	25%	57%	$24	52%	32%	95%	57%	$72

"Com. Fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Appendix C: Preview and Reminder Letters for the Northeast Mail Survey

The Northeast preview and reminder letters are presented in this appendix as an example for all surveys. Differences across the letters for other regions and the national survey are minor. The letters were tailored to refer specifically to resources in the respondent's region (e.g., "Southeast's rivers, streams, and bays" in the preview letter). The letters sent to households in the national survey sample refer to aquatic resources across the United States.

C.1 Preview Letter for the Northeast Mail Survey

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

I am writing this letter to let you know about an important survey regarding environmental protection and government regulations in the Northeast U.S. Over time, human activities have caused many changes in Northeast's rivers, streams and bays. The Environmental Protection Agency is considering policies that could impact the quality of fish and aquatic habitat in these areas. These policies can have different effects and costs. Because of this, it is important to know what types of policies are supported by Northeast residents.

Through a random process, your household was selected to receive a survey about some of these policies. This survey, *Fish and Aquatic Habitat — A Survey of Northeast Residents*, will help officials from the Environmental Protection Agency (EPA) to better understand the value of policies which would affect the future of fish and aquatic habitat in the Northeast. It will arrive in the next two weeks.

We selected your address, not you personally, as part of a scientifically-determined regional sample. Your participation is voluntary, and there are no penalties for not answering any questions. Your help, however, is very important. We cannot send this survey to everyone, so your answers will represent the opinions of many other Northeast residents like you and will provide valuable information that will help improve the regional survey.

Sometime in the next few weeks, you will receive a survey booklet by mail. By filling out this survey when it arrives, you will be participating in an important study that will help officials understand your priorities for the environment and the use of public funds. Your participation is extremely important to ensure that the survey results are complete and accurate. Your answers will be kept confidential to the extent provided by law. Please keep in mind that by quickly returning your complete survey, you will be helping to keep down government costs.

We hope that you find this survey important and interesting and thank you for your assistance in this important project.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

Internet Address (URL) • http://www.epa.gov
Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 100% Postconsumer, Process Chlorine Free Recycled Paper

OMB Control No. 2040-0283

C.2 Cover Letter for the First Mailing of the Northeast SP Survey

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

Within the last two weeks you received a letter informing you that through a random process, your household was selected to receive a short survey regarding environmental protection and government regulations in the Northeast U.S. Thank you for your participation—the survey booklet is enclosed with this letter. Your answers to the survey will help officials from the Environmental Protection Agency (EPA) to better understand the value of policies which would affect the future of fish and aquatic habitat in the Northeast. By filling out this survey, you will be participating in an important study that will help government officials understand your priorities for the environment and regulations.

Your responses to this survey are extremely important to ensure that the survey results are complete and accurate. Over time, human activities have caused many changes in Northeast's rivers, streams and bays. The Environmental Protection Agency is considering policies that could impact the quality of fish and aquatic habitat in these areas. These policies can have different effects and costs. Because of this, it is important to know what types of policies are supported by Northeast residents.

All answers to the survey are kept confidential to the extent provided by law. Once we have received your survey, we will delete your name from all lists, so that your responses can never be traced back to you. Of course, your participation is voluntary and you may refuse to answer any or all questions.

We hope that you find this survey important and interesting, and thank you for your assistance in this important project. We would greatly appreciate if you could return the survey in the near future.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

Internet Address (URL) • http://www.epa.gov
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OMB Control No. 2040-0283

C.3 Post Card Reminder for the Northeast SP Survey

FRONT

Abt SRBI
Government Services Divison
8403 Colesville Road, Suite 820
Silver Spring, MD, 20910

BACK

OMB Control No. 2040-0283

Last week a survey was mailed to you concerning environmental protection and government regulations in the Northeast U.S. If you have already returned your completed survey, please accept our sincere thanks.

If you have not yet completed your survey, we ask that you please do so today. You are one of a select few who have been chosen to participate—your answers will help us understand your priorities for the environment and regulations in the Northeast U.S.

If you have misplaced your survey, please contact Ryan Stapler at (617) 520-3524 or ryan_stapler@abtassoc.com for a replacement.

Regards,

Mary T. Smith
Environmental Protection Agency

C.4 Cover Letter for the Second Mailing of the Northeast SP Survey

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

Within the last few weeks a survey was sent to you regarding environmental protection and government regulations in the Northeast U.S. Our records indicate that you have not yet returned a completed survey. You are one of a select few who have been chosen to participate – your answers to the survey will help officials from the Environmental Protection Agency (EPA) to better understand the value of policies which would affect the future of fish and aquatic habitat in the Northeast. If you have not yet returned your survey, we ask that you please do so today. Another copy of the survey is enclosed with this letter.

Your responses to this survey are extremely important to ensure that the survey results are complete and accurate. Over time, human activities have caused many changes in Northeast's rivers, streams and bays. The Environmental Protection Agency is considering policies that could impact the quality of fish and aquatic habitat in these areas. These policies can have different effects and costs. Because of this, it is important to know what types of policies are supported by Northeast residents.

All answers to the survey are kept confidential to the extent provided by law. Once we have received your survey, we will delete your name from all lists, so that your responses can never be traced back to you. Of course, your participation is voluntary and you may refuse to answer any or all questions.

We hope that you find this survey important and interesting, and thank you for your assistance in this important project. We would greatly appreciate if you could return the survey in the near future.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

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OMB Control No. 2040-0283

C.5 Final Reminder Letter for the Northeast SP Survey

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

Within the last week a survey was mailed to you concerning environmental protection and government regulations in the Northeast U.S. Through a random process, your address was selected to receive the survey as part of a scientifically-determined regional sample. If you have not yet completed your survey, we ask that you please do so today. You are one of a select few who have been chosen to participate – your answers to the survey will help officials from the Environmental Protection Agency (EPA) to better understand the value of policies which would affect the future of fish and aquatic habitat in the Northeast.

Your responses to this survey are extremely important to ensure that the survey results are complete and accurate. Over time, human activities have caused many changes in Northeast's rivers, streams and bays. The Environmental Protection Agency is considering policies that could impact the quality of fish and aquatic habitat in these areas. These policies can have different effects and costs. Because of this, it is important to know what types of policies are supported by Northeast residents.

All answers to the survey are kept confidential to the extent provided by law. Once we have received your survey, we will delete your name from all lists, so that your responses can never be traced back to you. Of course, your participation is voluntary and you may refuse to answer any or all questions.

We hope that you find the survey important and interesting, and thank you for your assistance in this important project. We would greatly appreciate if you could return the completed survey in the near future. If you have misplaced your survey, please contact Ryan Stapler at (617) 520-3524 or ryan_stapler@abtassoc.com for a replacement.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

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OMB Control No. 2040-0283

Appendix D: Priority Mail Non-Response Questionnaire for the Northeast Region

6939249934

OMB Control No. 2040-0283
Approval expires 07/31/2013

Fish and Aquatic Habitat

A Short Survey of Northeast Households

(CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT)

9 9 9 9 9 9 9

7048249936

This is part of an important survey of U.S. residents for the Environmental Protection Agency, or EPA. It is a short questionnaire which should take no more than five minutes. This study will help us to better understand the value of environmental protection and public programs. Any answers you provide are kept confidential to the extent provided by law.

1. What is your age? ☐☐☐ years

2. What is your gender? O Male O Female

3. What is the highest level of education that you have completed?

O Less than high school	O One or more years of college
O High school or equivalent	O Bachelor's Degree
O High school + technical school	O Graduate Degree

4. How many people live in your household? ☐☐

5. How many of these people are 16 years of age or older? ☐☐

6. How many of these people are 6 years of age or younger? ☐☐

7. What is your zip code? ☐☐☐☐☐

8. Are you currently employed? O Yes O No

9. Are you currently employed in the commercial fish industry? O Yes O No

10. Compared to other issues that the government might address - such as public safety, education and health - how important is protecting aquatic ecosystem to you, on a scale of 1 to 5 where 1 is "not important" and 5 is "very important"?

O 1 O 2 O 3 O 4 O 5

11. People have ideas about the extent to which the government should be involved in protecting the environment. On a scale of 1 to 5 where 1 is "not at all involved" and 5 is "highly involved", how involved do you think the government should be in environmental protection?

O 1 O 2 O 3 O 4 O 5

9 9 9 9 9 9 9

1

7324249933

12. How many days did you participate in the following during the last year? For trips longer than one day, please count each day separately.

Boating / Canoeing / Kayaking	O 0	O 1-5	O 6-10	O 11-15	O 16+
Swimming / Going to the Beach	O 0	O 1-5	O 6-10	O 11-15	O 16+
Recreational Fishing (Fresh Water)	O 0	O 1-5	O 6-10	O 11-15	O 16+
Recreational Fishing (Salt Water)	O 0	O 1-5	O 6-10	O 11-15	O 16+
Shellfishing / Crabbing	O 0	O 1-5	O 6-10	O 11-15	O 16+
Scuba Diving / Snorkeling	O 0	O 1-5	O 6-10	O 11-15	O 16+

13. Do you consume commercially caught fish or seafood? O Yes O No

14. Do you consume recreationally caught fish or seafood? O Yes O No

15. Are you of Hispanic or Latino origin? O Yes O No

16. Which of the following racial categories describes you? You may select more than one.

O American Indian or Alaskan Native
O Asian
O Black or African American
O White
O Native Hawaiian or Other Pacific Islander

17. Which would best describe your living situation?

O Rent your home or apartment
O Own your own home
O Live with family or friends and pay part of the rent or mortgage
O Live with family or friends and do not pay rent
O Other (please specify) _____

18. What category comes closest to your total household income?

O Less than $10,000
O $10,000 to $19,999
O $20,000 to $39,999
O $40,000 to $59,999
O $60,000 to $79,999
O $80,000 to $99,999
O $100,000 to $249,999
O $250,000 or more

Thank you for participating in this very important survey!

9 9 9 9 9 9 9

2

Appendix E: Telephone Non-Response Screener Script

Hello, this is _____calling from the Abt Associates. We are conducting an important survey of U.S. residents for the Environmental Protection Agency, or EPA. This is not a sales call. This is a follow-up to a survey that was mailed to your household last week along with a letter from the EPA and a small incentive. Your participation is extremely important to ensure that the survey results are complete and accurate.

SL1

In order to select just one person to interview, may I please speak to the person in your household, age 18 or older, who has had the most recent birthday?

1	Rspn on line	**SKIP TO SL2**
2	Eligible rspn is not on phone	**SKIP TO SL1b**
3	Rspn unavailable	**SCHEDULE CALLBACK**
4	No respondent over 18	**THANK AND SCREEN OUT**
8	Don't Know (VOL)	**THANK AND TERMINATE – Soft Refusal**
9	Refused (VOL)	**THANK AND TERMINATE – Hard Refusal**

SL1b

May I speak with that person?

1	Rspn called to phone	**SKIP TO SL1c**
2	Rspn unavailable	**SCHEDULE CALLBACK**
8	Don't Know (VOL)	**THANK AND TERMINATE – Soft Refusal**
9	Refused (VOL)	**THANK AND TERMINATE – Hard Refusal**

SL1c

Hello, this is _____calling from the Abt Associates. We are conducting an important survey of U.S. residents for the Environmental Protection Agency, or EPA. This is a follow-up to a survey that was mailed to your household last week along with a letter from the EPA and a small incentive. Your participation is extremely important to ensure that the survey results are complete and accurate. Could we begin now?

IF ASKED: This is a short survey which should take no more than five minutes.

1	Yes	
2	No time	**SCHEDULE CALLBACK**
8	Don't Know (VOL)	**THANK AND TERMINATE – Soft Refusal**
9	Refused (VOL)	**THANK AND TERMINATE – Hard Refusal**

SL2

Do you have a cell phone in addition to the line on which we're speaking right now?

1	Yes, also have cell phone	
2	No, this is only phone	**SKIP TO SA2**
8	Don't know (VOL)	**THANK AND END, screen out**
9	Refused (VOL)	**THANK AND END, soft refusal**

SA1

Of all of the phone calls that you or your family receives, are…(Read List)

1 all or almost all calls received on cell phones,
2 some received on cell phones and some received on land lines, or
3 very few or none on cell phones.
8 Don't know (VOL)
9 Refused (VOL)

SA2

Record gender from observation. (Ask only if Necessary) (MATCHES QUESTION 13 IN MAIN SURVEY, MATCHES QUESTION 2 IN NON RESPONSE SURVEY)

1 Male
2 Female
8 Don't Know (VOL)
9 Refused (VOL)

Q1

First, compared to other issues that the government might address – such as public safety, education and health – how important is protecting aquatic ecosystem to you, on a scale of 1 to 5 where 1 is "not important" and 5 is "very important"? (MATCHES QUESTION 2 IN THE MAIN SURVEY, MATCHES QUESTION 10 IN NONRESPONSE SURVEY)

1 2 3 4 5 8 Don't Know (VOL) 9 Refused (VOL)

Q2

People have ideas about the extent to which the government should be involved in protecting the environment. On a scale of 1 to 5 where 1 is "not at all involved" and 5 is "highly involved," how involved do you think the government should be in environmental protection? (MATCHES QUESTION 11 IN NON RESPONSE SURVEY)

1 2 3 4 5 8 Don't Know (VOL) 9 Refused (VOL)

Q3a

Could you please tell me if you participated in each of following activities during the last year? (DO NOT ROTATE) (MATCHES QUESTION 10 IN THE MAIN SURVEY, MATCHES QUESTION 11 IN THE NON RESPONSE SURVEY)

Boating, canoeing, or kayaking		1 Yes	2 No	8 DK	9 RF
Swimming/going to the beach		1 Yes	2 No	8 DK	9 RF
Fresh Water Recreational fishing	1 Yes	2 No	8 DK	9 RF	
Salt Water Recreational fishing		1 Yes	2 No	8 DK	9 RF
Shell fishing or crabbing	1 Yes	2 No	8 DK	9 RF	
Scuba diving or snorkeling		1 Yes	2 No	8 DK	9 RF

(IF THE RESPONDENT DID NOT PARTICIPATE IN THE ABOVE ACTIVITIES SKIP TO Q4)

Q3b

How many days did you participate in the following during the last year? For trips longer than one day, please count each day separately. (MATCHES QUESTION 10 IN THE MAIN SURVEY, MATCHES QUESTION 11 IN THE NON RESPONSE SURVEY)

Boating, canoeing, or kayaking		1-5	6-10	11-15	16+
Swimming/going to the beach		1-5	6-10	11-15	16+
Fresh Water Recreational fishing	1-5	6-10	11-15	16+	
Salt Water Recreational fishing		1-5	6-10	11-15	16+
Shell fishing or crabbing	1-5	6-10	11-15	16+ Scuba diving	
or snorkeling 1-5	6-10	11-15	16+		

(VOL) 1=0 days
2=1-5 days
3=6-10 days
4=11-15 days
5=16+ days
9=Don't Know/Refused

Q4

Do you consume commercially caught fish or seafood? (MATCHES QUESTION 11 IN MAIN SURVEY, MATCHES QUESTION 13 IN NON RESPONSE SURVEY)

1 Yes
2 No
8 Don't Know (VOL)
9 Refused (VOL)

Q5

Do you consume recreationally caught fish or seafood? (MATCHES QUESTION 11 IN MAIN SURVEY, MATCHES QUESTION 14 IN NON RESPONSE SURVEY)

1 Yes
2 No
8 Don't Know (VOL)
9 Refused (VOL)

Now, I have just a few questions for classification purposes.

D1

NOTE: We should not accept any ages younger than 18 for this question

What is your age? (MATCHES QUESTION 12 IN MAIN SURVEY, MATCHES QUESTION 1 IN NON RESPONSE SURVEY)

_____ Years 8 Don't Know (VOL) 9 Refused (VOL)

D2

Could you please tell me how many people live in this household? (MATCHES QUESTION 15 IN MAIN SURVEY, MATCHES QUESTION 4 IN NON RESPONSE SURVEY)

_____ 8 Don't Know (VOL) 9 Refused (VOL)

D3

How many of these people are 16 years of age or older? (MATCHES QUESTION 16 IN THE MAIN SURVEY, MATCHES QUESTION 5 IN THE NON-RESPONSE SURVEY)

_____ 8 Don't Know (VOL) 9 Refused (VOL)

D4

NOTE: IF number of people in household = 1, skip this question

How many of these people are 6 years of age or younger? (MATCHES QUESTION 17 IN MAIN SURVEY, MATCHES QUESTION 6 IN NON RESPONSE SURVEY)

_____ 8 Don't Know (VOL) 9 Refused (VOL)

D5

What is the highest level of education that you have completed? Is it… (READ LIST) (MATCHES QUESTION 14 IN MAIN SURVEY, MATCHES QUESTION 3 IN NON RESPONSE SURVEY)

1 Less than high school
2 High school or equivalent
3 High school and technical school
4 One or more years of college
5 Bachelor's degree
6 Graduate degree
8 Don't Know (VOL)
9 Refused (VOL)

D6

Including everyone living in your household, which of the following categories best describes your total household income before taxes? Is it … (READ LIST) (MATCHES QUESTION 23 IN MAIN SURVEY, MATCHES QUESTION 18 IN NON RESPONSE SURVEY)

1 Less than $10,000,
2 $10,000 to $19,999,
3 $20,000 to $39,999,
4 $40,000 to $59,999,
5 $60,000 to $79,999,
6 $80,000 to $99,999,
7 $100,000 to $249,999
8 $250,000 or more
98 Don't know (VOL)
99 Refused (VOL)

D7

Are you of Hispanic or Latino origin? (MATCHES QUESTION 21 IN MAIN SURVEY, MATCHES QUESTION 15 IN NON RESPONSE SURVEY)

1 Yes
2 No
8 Don't know (VOL)
9 Refused (VOL)

D8

Which of the following racial categories describes you? You may select more than one. Would it be… (READ LIST – MULTIPLE RECORD) (MATCHES QUESTION 22 IN MAIN SURVEY, MATCHES QUESTION 16 IN NON RESPONSE SURVEY)

1 American Indian or Alaskan Native,
2 Asian,
3 Black or African American,
4 Native Hawaiian or Other Pacific Islander, or
5 White

6 Hispanic / Latino (VOL)
7 Other, specify (VOL)
8 Don't Know (VOL)
9 Refused (VOL)

D9

Do you… (READ LIST) (MATCHES QUESTION 17 IN NON RESPONSE SURVEY; NO CORRESPONDING QUESTION IN MAIN SURVEY)

1 Rent your home or apartment
2 Own your own home
3 Live with family or friends and pay part of the rent or mortgage
4 Live with family or friends and do not pay rent
7 Other, Specify (VOL)
8 Don't Know (VOL)
9 Refused (VOL)

D10

What is your zip code? _____ (MATCHES QUESTION 18 IN MAIN SURVEY, MATCHES QUESTION 7 IN NON RESPONSE SURVEY)

8 Don't Know (VOL)
9 Refused (VOL)

D11

Are you currently employed? (MATCHES QUESTION 19 IN MAIN SURVEY, MATCHES QUESTION 8 IN NON RESPONSE SURVEY)

1 Yes
2 No **SKIP TO CLOSING**
8 Don't Know (VOL)
9 Refused (VOL)

D12

Are you currently employed in the commercial fish industry? (MATCHES QUESTION 20 IN MAIN SURVEY, MATCHES QUESTION 9 IN NON RESPONSE SURVEY)

1 Yes
2 No
8 Don't Know (VOL)
9 Refused (VOL)

CLOSING:

Thank you very much for your time, and have a great evening/day

Appendix F: Preview and Cover Letters for the Non-Response Study

F.1 Cover Letter for the Priority Mail Non-Response Study

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

Within the last few weeks you received a survey regarding environmental protection and government regulations. Our records indicate that you did not return the completed survey.

We are no longer asking that you complete the full survey. However, a brief questionnaire is enclosed with this letter that should take less than 5 minutes to complete. Also included is $2 in cash as an unconditional incentive for your participation.

By filling out this short questionnaire, you will allow EPA to correctly generalize the results of the mail survey you received previously to all households. All answers to the survey are kept confidential to the extent provided by law.

We would greatly appreciate if you could return the questionnaire in the near future.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

Internet Address (URL) • http://www.epa.gov

OMB Control No. 2040-0283

F.2 Preview Letter for the Telephone Non-Response Study

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

Dear Resident:

Within the last few weeks you received a survey regarding environmental protection and government regulations. Our records indicate that you did not return the completed survey.

We are no longer asking that you complete the full survey. However, we will be contacting you by phone to participate in a brief telephone survey that should take less than 5 minutes. Included with this letter is $2 in cash as an unconditional incentive for your participation in the telephone survey.

By participating in this telephone survey you will allow the EPA to correctly generalize the results of the mail survey you received previously to all households. All answers to the telephone survey are kept confidential to the extent provided by law.

Thank you for your assistance in this important project.

Sincerely,

Mary T. Smith, Director
U. S. Environmental Protection Agency
Engineering and Analysis Division

Internet Address (URL) • http://www.epa.gov

OMB Control No. 2040-0283

Appendix G: Preliminary Northeast Models

This appendix presents the results of the preliminary models run by EPA for the Northeast in addition to three models presented in Table 8-5. Section G.1 presents the results of a linear model with interactions for gender and education. [redacted]

G.1 Northeast Linear Model with Interactions for Gender and Education

As described in Section 7.2, EPA found statistical differences in the gender and education level of respondent and non-respondent populations for the Northeast region. Based on the testing results, EPA conducted additional analysis with the linear Northeast model to evaluate the need to include weights accounting for gender and education. The Agency did this by re-estimating the model with interactions for two dummy variables: (1) college, which identifies college-educated respondents, and (2) female, which identifies female respondents. The results of the model with interactions are presented in Table G-1. The "linear model without interactions" is identical to the "linear model" presented in Table 8-5.

Results from the linear model with interactions for gender and education are inconclusive overall. Mixed logit model statistics indicate a statistical fit that is comparable to the model without interactions, with a model χ^2 of 510.93 (d.f. = 33, $p<0.0001$) and a pseudo R^2 of 0.22. The interaction variables college*com_fish, college*fish_sav, and female*fish_sav are individually statistically significant. However, the fact that the model χ^2 for the interactions model is lower than for a comparable model without interactions (518.40) implies local rather than global convergence for the mixed logit interactions model.[33] Although these convergence difficulties indicate that the results of the interactions model should not be relied upon directly for welfare estimation, the individual significance of some of the interacted education and gender variables point to the possible need to include weights for gender and education in whatever model is used. In particular, interactions with fish saved are significant for both education ($p<0.01$) and gender ($p<0.05$). These interactions are notable because fish saved (*fish_sav*) is the only environmental attribute that EPA is using to estimate regulatory benefits at this time. A lack of demographic weights could potentially influence estimated WTP for fish saved due to the over- or under-representation of certain demographic groups in mail survey data. EPA decided to estimate weighted models based on these results and the significant differences in demographic characteristics across respondent and non-respondent samples for the Northeast and other regions.

[33] The Northeast model with interactions for gender and education was estimated before the final Northeast mail survey dataset was available. It was estimated based on 394 of the 421 observations in the final dataset. EPA also estimated a linear model without gender and education interactions using the same 394 observations. It had a model χ^2 of 518.40.

Table G-1—Results for the Northeast Linear Model with Interactions for Gender (*female*) and Education (*college*) and Northeast Linear Model without Interactions

Variable	Coefficient [a,b] (Standard Error)	
	Linear Model with Interactions for Gender and Education [c]	Linear Model without Interactions
Random parameters in utility functions		
CONSTANT	-0.11591 (0.44143)	-0.14284 (0.26495)
COM_FISH	0.18027*** (0.06949)	0.25448*** (0.05395)
FISH_POP	0.07348 (0.10314)	0.09181 (0.07052)
FISH_SAV	0.02767*** (0.00857)	0.02794*** (0.00607)
AQUATIC	0.17045 (0.11677)	0.24403*** (0.08794)
Non-random parameters in utility functions		
COST	-0.02720*** (0.00560)	-0.02913*** (0.00433)
COLLEGE*CONSTANT	0.21781 (0.56578)	-
COLLEGE*COM_FISH	0.13960* (0.07728)	-
COLLEGE*FISH_POP	0.01544 (0.12576)	-
COLLEGE*FISH_SAV	0.04490*** (0.00830)	-
COLLEGE*AQUATIC	0.13699 (0.12766)	-
COLLEGE*COST	-0.02720 (0.00560)	-
FEMALE *CONSTANT	-0.23947 (0.53138)	-
FEMALE *COM_FISH	0.01361 (0.07840)	-
FEMALE *FISH_POP	0.07421 (0.12132)	-
FEMALE *FISH_SAV	0.01836** (0.00791)	-
FEMALE *AQUATIC	0.05411 (0.12544)	-
FEMALE*COST	-0.00317 (0.00746)	-
Derived standard deviations for parameter distributions		
sdCONSTANT-	0.03890 (0.65397)	0.00694 (1.02871)
sdCOM_FISH-	0.13270 (0.09846)	0.11153 (0.15991)
sdFISH_POP-	0.13294 (0.21716)	0.15133 (0.30835)
sdFISH_SAV-	0.08309*** (0.01321)	0.07605** (0.03763)
sdAQUATIC-	0.28535 (0.31368)	0.36392 (0.30161)

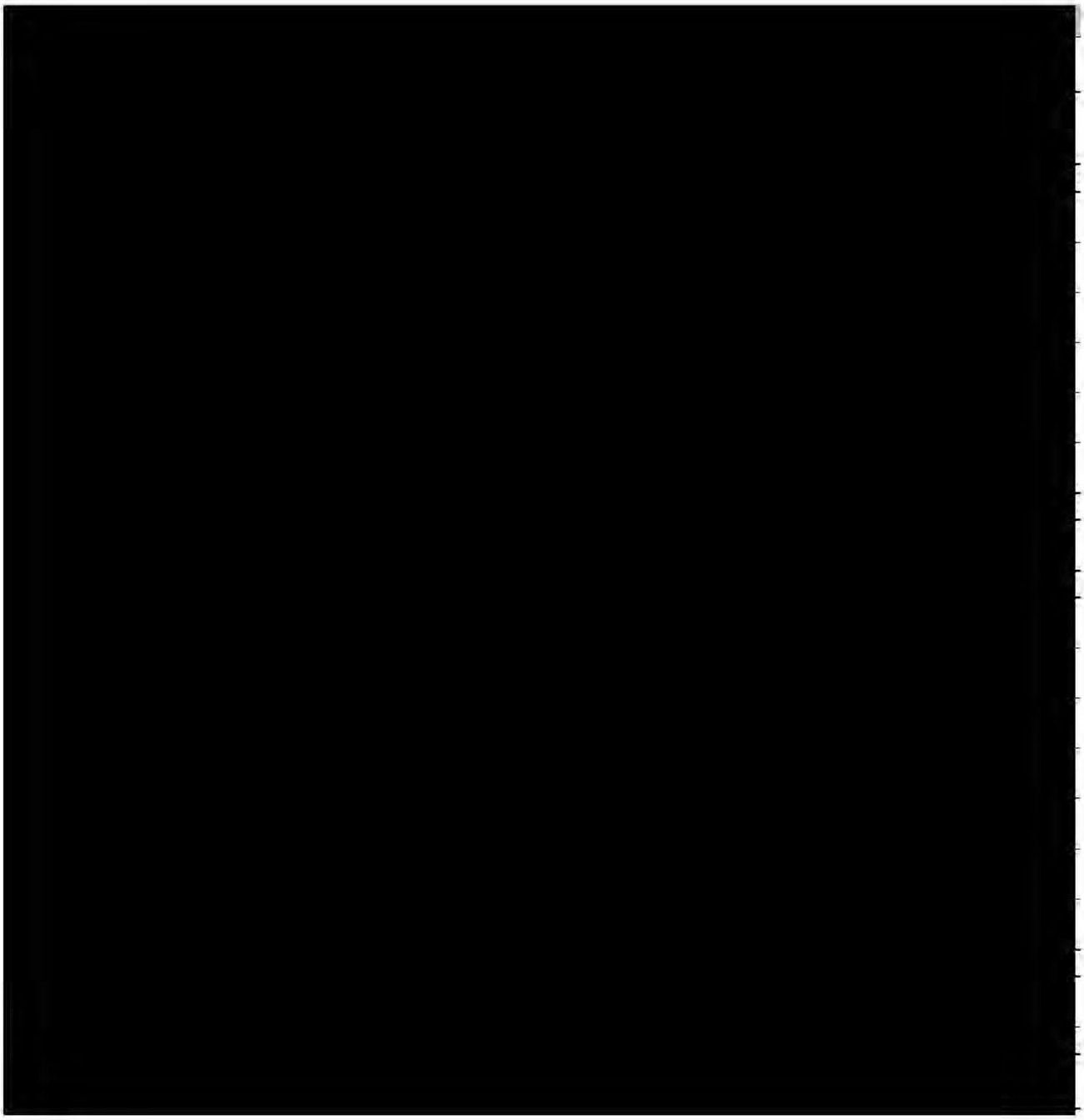
Table G-1—Results for the Northeast Linear Model with Interactions for Gender (*female*) and Education (*college*) and Northeast Linear Model without Interactions

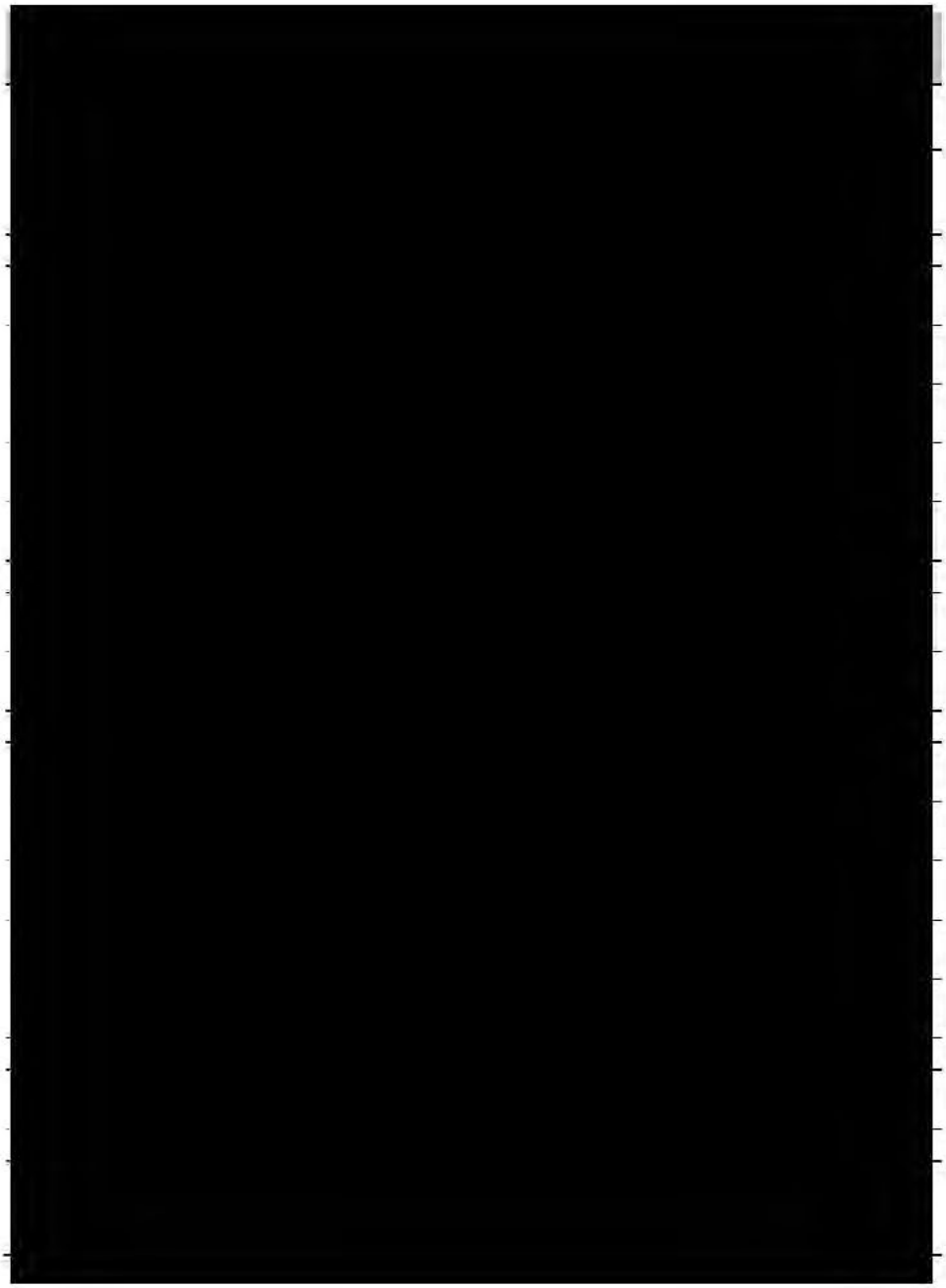
Variable	Coefficient [a,b] (Standard Error)	
	Linear Model with Interactions for Gender and Education [c]	Linear Model without Interactions
Model significance		
Model χ^2	510.93 (d f. = 33, p<0.0001)	505.90 (d f. = 21, p<0.0001)
Pseudo R^2	0.22	0.21

[a] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

[b] ***, **, * indicates significance at 1%, 5%, 10% levels, respectively.

[c] The Northeast model with interactions for gender and education was estimated before the final Northeast mail survey dataset was available. It was estimated based on 394 of the 421 observations in the final dataset.





Appendix H: [redacted]

[redacted]